1894.

LOCOMOTIVE ENGINEERING

A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER AND ROLLING STOCK.

INDEX TO VOLUME VII.

[*Articles marked with an asterisk (*) are illustrated.*]

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ASKED AND ANSWERED.

[The figures noted in this department relate to the number of the question asked.]

NEW BOOKS.

SPECIAL OFFER

FOR

1895.

WITH A YEAR'S SUBSCRIPTION for 1895 we will send a neat little book, entitled "**Standard Form of Examination of Firemen for Promotion, and Engineers for Employment.**" This is the uniform plan of examination adopted by the Traveling Engineers' Association, at the Annual Meeting, September, 1894. Every Engineer and Fireman MUST know the answers to the questions in this book sooner or later. You get the book FREE with the paper for 1895.

We shall also send out a **Dictionary Chart of Sleeping and Passenger Cars**, similar to the famous "999" transparency of 1894, and a fine **Colored Picture**, for framing, of a handsome, modern, **Ten-Wheeled Passenger Locomotive**. This picture will be the finest thing ever attempted in the Locomotive line.

The paper itself will be the best and most interesting Railroad Paper ever printed we will leave it to you if it is not.

CASH COMMISSION TO CLUB RAISERS.

Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock.

VOL. VII, No. 1. NEW YORK, JANUARY, 1894. 20 Cts. Monthly / $2.00 Per Year.

Some American Locomotives for Chili.

The Rogers Locomotive Co., of Paterson, N. J., have just turned out twelve 10-wheeled locomotives for the Government of Chili, S. A. Rogers locomotives were among the first used in that country and have a good reputation there, yet the new ones just built have a few European features, especially noticeable in the tank.

The illustration on this page gives a very good idea of the general appearance of the engines. Their principal dimensions are as follows:

Gauge of road, 5 ft. 6 in.
Fuel, bituminous coal.
Total wheel base of engine and tender, 42 ft. 6 in.
Total wheel base of engine, 23 ft. 8 in.
" " tender, 11 ft.
Driving-wheel base, 13 ft. 4 in.
Weight in working order on drivers, 80,000 lbs.
Weight in working order on truck, 32,000 lbs.
Total weight, 112,000 lbs.
Cylinders, 18x24 in.
Diameter of driving-wheels, 50 in.
" truck " 28 in.
Style of boiler, wagon top with crown bars.
Diameter of boiler, 54 in.
Size of firebox inside, 67 in. long x 43 in. wide x 70 in. deep.
Material of boiler, steel.
" of firebox, copper.
Tubes, material, brass.
" number, 182.
" outside diameter, 2 in.
" length, 12 ft. 2¾ in.
Grate area, 20 sq. ft.
Boiler feed, two No. 9 Monitor injectors.

TENDER.

Weight ready for service, 72,000 lbs.
Wheels, number, 6.
" diameter, 48½ in.
" kind, steel tired.
Kind of tender frame, steel slabs.
Tank capacity water, 2,500 imperial galls.

All wheel centers, both on engine and tender, are of wrought iron, the counterweights being forged in the drivers.

Order was received at the works October 5th, and the first engine was completed eight weeks later. Considering that some of the material had to be ordered from Europe, this is a very creditable performance indeed.

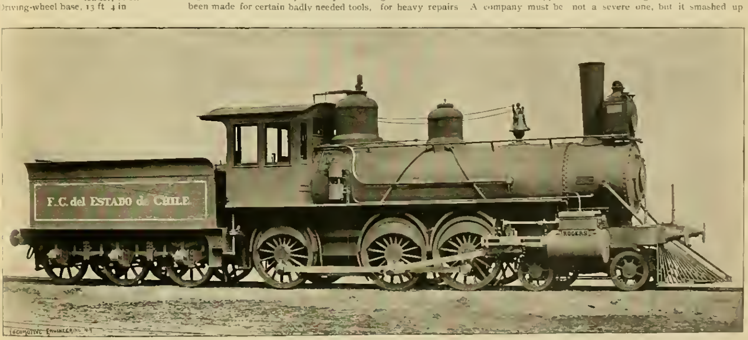
The Cheapest Tools in the Market.

In the course of the last few years we have had a great deal to say about the expensive policy of purchasing inferior material for use on railroad rolling stock, and several persons influential in the purchasing of goods have informed us that they have been converted by the sound business principles inculcated in these pages. Our labors in this direction have generally been devoted to the advocacy of first class material for the construction of locomotives and cars. A conversation which the writer heard in a railroad office during a recent journey moves us to say something about the policy of purchasing inferior tools to be employed in the repairing of railroad machinery. A request had been made for certain badly needed tools, and the matter was under consideration. The general superintendent, who had the deciding voice, was considering prices. The quotations of first-class firms were surprisingly low, but even these were not satisfactory. The prices of what is known as a maker of decidedly inferior tools were examined, and the decision was rendered that the tools at that price were good enough for these times.

The selecting of tools for a machine shop or for a planing mill is nearly as serious a matter as the selecting of a wife, for they are likely to be with a man all his lifetime. Every tool of this kind ought to be strong, durable, and sufficiently accurate to turn out good work. If it does not possess these attributes, it is an unsatisfactory article from the first day it is connected with the line shaft. Ten per cent. difference in the price of a good tool and of one not likely to prove satisfactory ought to cut no figure in the selection of the best. Private concerns and manufacturers who have to meet competition are aware that they cannot afford to use inferior tools, and railroad managers ought to understand that their company's interests are perverted when tools are purchased that will keep the expense of production at a high figure.

If the men who decide on the quality of tools to be purchased for railroad shops would examine the tool shops and planing mills of the companies that make locomotives and cars, they would learn that the best is not too good for such places. Why should less than the best be forced into why railroad shops should receive the best railroad shops? There is special reason of everything, for they are rarely granted renewals while a tool will hold together.

The practical effect of saving a few hundred dollars and getting a cheap tool is that the cost of finishing work is higher than it ought to be, and the saving in first cost is wasted in a year or two by the added cost of labor to make the product pass inspection. Every year the tool becomes poorer and less efficient. At a period of its life when a first-class tool would be as good as new, the inferior article is stopped for heavy repairs. A company must be rich to stand the drain of all its shops equipped with the cheapest tools in the market.



FOR THE GOVERNMENT RAILROADS OF CHILI. BUILT BY ROGERS LOCOMOTIVE CO.

Wanted, Facts.

A particularly bright engine-house foreman, who is of most observing habits and full of ingenious ideas about his business, was asked to give the readers of LOCOMOTIVE ENGINEERING the benefit of his experience and observation by writing some articles for the paper. He tried to escape by pleading that he knew little about grammar, was a poor speller, and was ignorant of the rules of composition. As there are other men, running over with information that would be valuable and interesting to our readers, who permit the flowers of their knowledge to blush unseen because grammar and spelling are stumbling-blocks between them and the light of day, we want to say that we are always ready to trim the grammar and spelling if people will send us *facts* worth publishing. Several of our most admired correspondents display extreme independence concerning orthography and syntax, but that does not restrict their ideas on railroad rolling stock, and their articles are always readable and duly paid for. What we want is the writing to be plain enough so that we can make out the words intended. We also like to have the writing confined to one side of the paper. Men who have ideas, and especially facts, will be acceptable writers for this paper if they will follow the suggestions made. We don't care for opinions and don't pay for them. We give them away gratis to people who visit this office. That is, those which we think our readers don't want, and they are easily satiated with that kind of mental hash.

A peculiar accident happened on the Lehigh Valley during the recent strike. Some of the men put to running locomotives didn't know any more about it than the law allows, and one of these men ran into the rear of a freight train, the collision was not a severe one, but it smashed up a couple of cars, disabling the train struck but not the train or engine doing the striking. The "hog" was "in the britching" and wide open, and commenced to back up her train. The crew having "hit the grit" there was no one to stop her, and she was soon sailing *down* on the *up* track, and met engine "300," President Wilbur's special engine, with her train. She "hit the band wagon" (as a striker described it), and tangled up the rear car of her train and the "300," but did not derail anything. Then she kept on backing, with her captured special added, until they met the fourth train and smashed into that. Having crippled four trains within fifteen minutes, and being low in steam the "hog" took a rest to get a better hold—and a new canal boat engineer to run her.

Valentine & Co. have recently completed additions to their storage room for varnish at their factories in Brooklyn. One new tank room has a capacity of 145,000 gallons, and the two old ones 74,000, giving storage room of 219,000 gallons at the works alone, exclusive of the storage capacity of the many agencies and the stock in the factory proper. Varnish, like other popular and slippery liquids, improves with age, and anyone would think this supply would give some of it a chance

*Diseases of the Air Brake System; Their Causes, Symptoms and Cure.

By PAUL SYNNESTVEDT.

In submitting the following work to the railroad public it is proper that the author should begin with a few words of explanation.

I do not wish, like many authors, to apologize for what I have done, and I do not wish to belittle my own exertions, for the preparation of the work has cost considerable labor, but I do wish to ask the indulgence of critical readers, submitting it as a truth, self-evident, that no man's work is infallible, and acknowledging in all humility that many air-brake doctors, some of them in their lines more competent than I, may find fault with many of the prescriptions that I have written.

In spite of all this, however, I am not without hope that my work, incomplete and imperfect though it may be, will, in a measure at least, supply a long felt want.

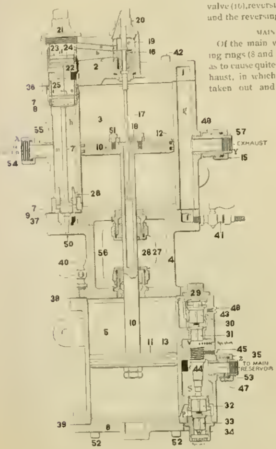
To those desirous of becoming good air-brake "doctors," I would say Always use your *reason* first and your HANDS afterward.

Never try to fix more than one thing at a time

Never take anything to pieces without having some reason for doing it

Treat your case just as a doctor does his patient, first finding out the nature and cause of the disease, and then prescribing and applying the remedy.

The time that can be saved and the vexation that can be avoided by pursuing this course will astonish any one willing to give it a fair trial.



Westinghouse Eight-Inch Pump—Plate 2

Eight-Inch Westinghouse Pump Plate 2.

The disorders that arise in this pump may be classed under two general heads

1st. Trouble in the upper or steam cylinder

2d. Trouble in the lower or air cylinder.

The parts in the upper cylinder most liable to derangement are the main-valve (7), reversing piston (23), reversing-valve (16), reversing-valve stem (17), and the reversing-valve plate (18).

MAIN VALVE.

Of the main valve (7), the packing rings (8 and 9) become worn so as to cause quite a blow into the exhaust, in which case they must be taken out and new ones fitted. When this is done, the bushings (25 and 26) should be carefully calipered and replaced with new ones if they are worn out of true (larger diameter in the middle than at the ends)

Quite frequently the small nut on the top of the main valve works loose and comes off, sometimes causing stoppage of the pump This may require renewal of the valve-rod. The nut should be made to go on hard, and should be riveted fast when screwed down.

If the small stop-pin (50) gets broken or worn too short, the pump will stop because of the main-valve traveling down so far as to allow the lower small packing ring to expand below the bushing and catch. Although a little thing to repair in itself, it requires considerable work and much care. Some have done it without taking the pump apart by forcibly pulling out the main-valve, drilling out the stub of the pin (50) and inserting a new one from above by means of a stick with a socket in the end. This forcible removal of the main valve will generally break the small ring or spider, or both, and necessitate their replacement.

REVERSING PISTON (23)

The reversing piston is generally the first thing to require attention in case the pump stops. This is due largely to the fact that when a pump is run short of oil, the reversing piston gets scarcely any on account of its location, the oil tending downward rather than upward. The rings (24) when they are loose or worn so as to open wide at the joint should be replaced, as also the bushing, if it is out of true or worn large in the opening through which the rod works

Often the rod breaks off just at the point where it joins the piston head. This will render the pump liable to frequent stoppage, due to the head being without a guide, traveling so far upward as to partially close the upper ports, or tilting over so as to catch.

Rapping the pump lightly on the top of the outer cap will often start it by jarring the reversing piston head down into place.

It may here be noted that a pump that requires frequent rapping to keep it going is in need of overhauling

REVERSING VALVE (16) AND STEM (17).

The reversing valve itself does not give as much trouble as the spindle or stem (17) which operates it. If the valve seat becomes badly worn, a new valve should be substituted and it should be a pretty close fit inside of the bushing. Any disarrangement of the reversing valve or spindle generally results in an erratic stroke of the pump, jumping, or "jiggling," or half stroke, caused by its reversing at the wrong time. The spindle should fit snugly, both where it passes through the bushing and in its bearing in the top cap. If badly worn in either place, the spindle and often the cap and bushing, also, should be replaced with new ones Another place very liable to excessive wear is where the spindle is struck by the reversing plate (18), and the shoulder and button on the spindle, and both sides of the plate should be carefully examined, especially if a pump pounds badly. The under side of the plate generally wears the most rapidly, and must not be overlooked in making an examination. If the reversing rod gets bent slightly it may rub against the plate hard enough to cause the pump to reverse at the wrong time.

Straightening the rod is of course all that is necessary to remedy this. In putting the top head on after repairing, the copper gasket should be examined to see that it does not cover the small port through which steam goes to the reversing valve cavity in the top head.

LOWER OR AIR CYLINDER.

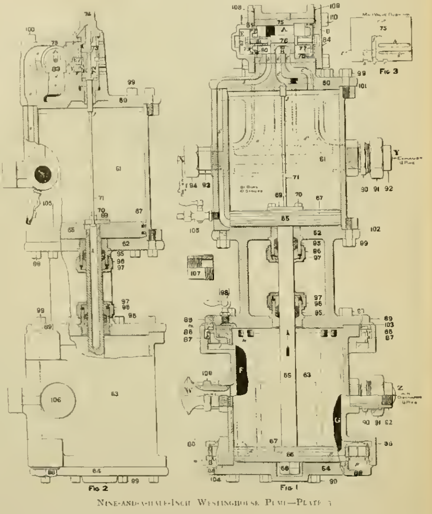
The parts in the lower or air cylinder most liable to derangement are the air-valves (30, 31, 32 and 33). They become worn so as to lift too far, which will result in the pump pounding. They must be replaced with new ones, having the projection on top filed down just enough to give them the right amount of lift.

Authorities differ slightly as to what this should be. Some say about 1/8 of an inch. The discharge-valves (30 and 32) should not have as much lift as the receiving-valves (31 and 33).

Sometimes the valve-chamber bushings (43 and 34) become worn so badly where the valves seat that they must be replaced.

Occasionally one of the air-valves gets broken. Any difficulty with these valves can generally be detected by careful examination of the suction of the air at the inlet ports. If the air blows back at the beginning of the stroke, the receiving-valve does not seat properly. If the suction is very weak, either the discharge-valve is not seating properly or else the packing rings (13) in the main piston head are blowing. The latter difficulty, which is very common, can be detected by taking off the lower head and working the pump very slowly, holding a light under the piston head.

These rings (13), as also those in the steam cylinder (12), not infrequently require renewal.



Nine-and-a-half-Inch Westinghouse Pump—Plate 3

REBORING CYLINDERS.

Of course, when either the upper or lower cylinder becomes badly worn, it must be rebored. Putting new rings into a cylinder which is unevenly worn does not do very much good.

Another trouble that has been found in the lower cylinder is the working loose of the nut (58) that holds the piston-head on the rod. This will either result in stopping the pump (in case the nut strikes the lower head before the piston has traveled far enough to reverse) or it will cause the piston-rod to wear into the head, constantly aggravating the difficulty. One case came under the writer's notice in which the rod had punched its way entirely through the head.

SYNOPSIS.

In general, the various disorders of the pump of most common occurrence are

"Stoppage" (complete) Cannot be remedied by rapping or coaxing.

"Stoppage" (temporary or occasional) Pump can generally be started by rapping.

"Pounding."

"Heating."

"Jiggling" or "Fluttering."

Unequal stroke (fast on one stroke, slow on the other).

Fairly rapid stroke, but low effective capacity (pumps little air).

"STOPPAGE" COMPLETE.

This may be due to the stop-pin (50) being broken (see page 7); the small nut on top of the main valve being loose (see page 7); the small port to the reversing-valve chamber being obstructed (see page 9), or the nut (58) working loose.

"STOPPAGE" (TEMPORARY OR OCCASIONAL).

This may be due to lack of oil in the steam valves (especially the reversing-piston 23), broken reversing piston-rod (see page 8); loose nut on top of main steam-valve (see page 7); badly worn packing-rings in main steam-valve, or reversing-piston; or sometimes excessive wear of the reversing-valve plate (18), (see page 9).

"POUNDING."

Pounding may be due to any one of a great variety of causes.

It may be a pounding of the steam-valves, air-valves, or main piston itself. Anything which will allow the main piston to strike either cylinder-head before the pump reverses will cause a heavy "pound." This may result from too tightly fitted steam-valves or rings, or rings too loose, either causing sluggish motion in the reverse movement, dryness in the steam cylinder-valves; badly worn reversing-valve plate or stem, or too long a reversing-valve stem.

A pump may also pound if the air-valves have too much lift. This can generally be detected by a careful examination of the suction ports, to see whether the air is drawn in properly at the very beginning of the stroke.

"HEATING."

This most frequently results either from dirt or gum in the discharge passages or too much clearance of the piston in the air-cylinder. Of course, if a pump is run full speed for a long time it is sure to heat more or less, one inevitable consequence of compressing air being the accumulation of heat. This is a case where a grain of prevention is worth a pound of cure. If a pump gets very hot it must be practically stopped and allowed to cool before much can be done to it. If notice is taken of it before it reaches what might be called the "explosive" point, a slight reduction in speed with a very little good valve oil in the air-cylinder may save further trouble.

Many have asked the writer if water should be used to cool it.

There certainly can be no serious objection to this provided the pump be stopped before the water is poured on, so it will not be sucked into the cylinder. All scientific air-compressors used in mines or similar service are "water jacketed."

A pump that has been "dosed" for some time with too much oil in the lower cylinder is almost sure to heat, simply because the air-discharge passages become clogged with gum.

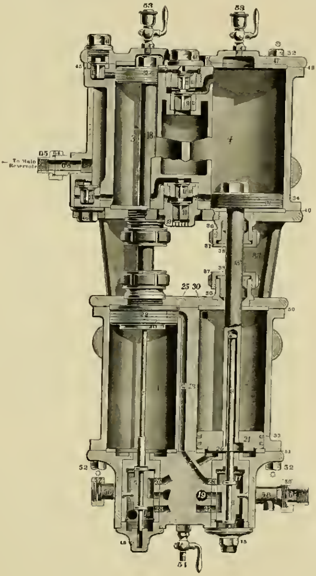
"JIGGLING" OR "FLUTTERING."

This term is used to designate a kind of jumping or short, catching stroke, and is almost always due to some trouble in the reversing-valve or stem. (See page 9.)

"GROANING."

This may be said to indicate lack of oil, yet it has been noted by many men that the pumps that have been getting the largest quantities in the air cylinder are most liable to make this noise.

This fact is hard to explain. The writer will only say that a "groaning" pump is frequently helped by thorough cleaning of the air cylinder and careful use of oil thereafter.



New York Duplex Pump—Plate 4.

"UNEQUAL STROKE."

This is generally caused by unequal lift of the air discharge-valves (30 and 32). If the up stroke is slower than the down stroke valve (30), has less lift than valve (32), and *vice-versa*.

The other causes of this trouble will be found in sluggish action of the steam-valves.

"FAIRLY RAPID STROKE, BUT LOW EFFECTIVE CAPACITY."

This trouble is always found in the air-cylinder. Either the valves do not seat properly, the piston has too much clearance, the rings (13) leak, or the cylinder is worn out of true. (See page 11.)

Nine-and-a-Half-Inch Westinghouse Pump—Plate 3.

The latest design of pump furnished by the Westinghouse Company is shown in Plate 3. It has not yet been in service long enough to enable any one to write a very complete account of the disorders to which it is subject, and a few remarks concerning it will suffice at present.

All the valve motion for the steam cylinder is in the top head, so that in the case of any failure to work properly a new head can be substituted until the old one can be fixed. There are a number of points in which this pump is similar to the 8-inch pump, and in which it will be liable to the same troubles.

It has the same arrangement of hollow piston-rod, reversing stem and valve, and a similar bushing in which this valve works, and as these parts perform practically the same function in this pump that they do in the other, any irregularity in their action will produce practically the same effect. If the reversing-valve stem is too long between the shoulder and button the pump will pound and may not be prompt in reversing, and the same thing will occur after the reversing-valve plate or this shoulder or stem become badly worn. If the distance between the shoulder and button be too small the pump will have too much clearance and will heat in consequence.

An unequal stroke will result in case the lift of the upper and lower air-valves wears unevenly.

"Jiggling," or short imperfect stroke, will result in case any wear or unevenness causes a movement of the reversing-valve (72) at any point other than the limit of stroke, when the shoulder or button of the stem is struck by the reversing-valve plate.

Of course, the small packing rings in the two heads of the differential piston will wear out in course of time and will then have to be renewed. The grooves in which they are fitted, and the bushing in which the valve works, will also wear so as to require renewal, but I have not heard of any of these pumps which have been in service long enough yet to make such treatment necessary.

New York Duplex Pump—Plate 4.

The duplex pump not having been in service as long as the Westinghouse 8-inch pump, it is hard to find men well enough acquainted with it to say just what are its weakest points. The point on which the writer found the most complaint was a noticeable tendency to heat, especially in case of any carelessness in regulating the quality or quantity of its oil supply. "An ounce of prevention is worth a pound of cure," is a saying that is even more applicable to this pump than any of the others in avoiding trouble from heat.

Of course, the main pistons and their packing rings in this pump will wear the same as in any pump, and after a long period of service the cylinders will become worn out of true and require reboring.

This state of affairs will manifest itself by a blow at the steam exhaust or a noticeable reduction in the efficiency of the pump without any apparent reduction in speed of stroke. There will also be an aggravation of the tendency to heat, due to a part of the air being churned back and forth by the packing rings. Let us repeat here what was intimated before in treating of the other pumps, that nothing will cause a pump to heat so badly as leaky packing rings or too much clearance in the air cylinder. If there is practically no air left in the cylinder at the end of each stroke so an entirely new supply may be drawn in each time from the atmosphere there will be little trouble from heating.

If this pump begins to pound very badly the reversing valves (5 and 6), stems (7 and 8), and plates (20) must be carefully examined to see if they are worn in any part, and new ones should be substituted if necessary. The points where this wear is greatest are the shoulder and button on the stem and the plate itself.

The Pennsylvania Railroad people some years ago began putting the sandboxes for locomotives under the running boards, the idea being that there would be less obstruction to the view of the engineer on curves than there was with the sandbox on the boiler. The thing has not worked well, however, and it is likely that in future sandboxes will be put on the boiler. The difficulties that bring about the change are dampness, and the sand forming into a solid core in the bottom of the tapered boxes. A curious thing has been discovered in connection with the sand getting wet in sandboxes. It was found that the sand in wrought-iron boxes was nearly always damp, while that in cast-iron boxes was seldom in that undesirable condition. Wrought-iron and pressed steel sandboxes were coming rapidly into use, but there was so much trouble with damp sand in them that they are being abandoned and the rejected cast-iron substituted.

There has been some talk about an absurd movement on the part of a combination of hotel keepers in Chicago to sue the railroad companies for not reducing their fares earlier in the season, so that more people would have been able to visit the World's Fair. From what we saw of the Chicago hotels early in the season we think that the suit ought to be in the other direction. The general rapacity displayed by the Chicago hotel keepers when the Fair was first opened no doubt prevented thousands of people from visiting Chicago who intended to go. The belief became wide spread that Chicago hotel keepers were going to rob visitors, and it was only when the small volume of strangers kept many hotels empty that prices were made nearly reasonable.

Engine Failures on the Union Pacific Railroad.

Some Interesting Figures from a System where a Delay of Five Minutes is Charged as an Engine Failure.

A great deal of interest has been manifested lately in the subject of "engine failures," and there is likely to be considerable good done by the agitation in the way of reducing failures. But one of the first things to settle in this connection is the question, "What is an engine failure?"

In the November issue of the *American Engineer and Railroad Journal*, Mr M N. Forney publishes a table of engine failures on a large road (not named) having upward of a thousand locomotives

This table is good so far as it goes, but it does not go far enough.

An engine failure is properly any defect of any part of the engine or tender that delays a train, and such defects may properly be put into three classes, as follows

1 Failures of machinery
2 Not steaming.
3 Running hot

The road named deals only with the first of these, and if the second and third were added the totals would be greatly increased

The Union Pacific makes a sort of specialty of engine failures, and we decided to get a report from that road, and are now able to give our readers the benefit of it

On this road any delay of five minutes to a train is called an engine failure, even if a hose under a coach bursts

All delays of five minutes or more are reported to the general manager by the superintendent of car service, these are charged up as engine failures, and the superintendent of motive power is notified of all the engine failures of the day

Each failure is noted on a separate blank, provided for that purpose, and sent to the division master mechanic in charge of the engine that failed and he investigates. A special blank is provided for an engineer's report, every minute lost is put down, and the place designated and the cause given Thus each case is followed up and delays are reduced to a minimum, by getting at and remedying the cause

To those who are not familiar with the topography of the road or the engines, we will say that they have grades on the narrow gauge system of 225 feet to the mile. On the broad gauge system the longest grade is from Cheyenne to Sherman, a distance of thirty-four miles, where the average grade is 80 feet to the mile. On other divisions the grades run as high as 146 feet to the mile. From Evanston to Ogden, distance seventy-five miles, there is a difference in the altitude of 3,000 feet, the maximum grade being 96 feet to the mile.

The largest number of failures occurs on one division the Wyoming. On that division they have the heaviest power and very bad water On the district between Rawlins and Green River, a distance of 137 miles, the water is of such a character that the engines have to be washed out at each end of the trip, and cannot make but 137 miles without having the boiler washed. All failures from engines leaking are included in this report.

They have in service 93 consolidation engines, 127 10-wheeled engines with 19 x 24-inch cylinders, 132 10-wheeled engines with 18 x 24-inch cylinders, 235 8-wheeled engines with 18 x 24-inch cylinders, 151 8-wheeled engines with 17x24-inch cylinders, and 87 8-wheeled engines with less than 17-inch cylinders. There are a number of 6-wheeled switchers, and some odd sized engines and 82 narrow gauge engines, making a total of 1,029 locomotives on the system.

The number of engines in daily service on passenger and freight amounts to from 600 to 700 engines per day, and during the twelve months ending November 1 1893, the number of engines making trips was 231,834, with a total of 1,688 failures, or *less than three-quarters of one per cent.* Of this number 586 were passenger failures and 1,102 freight failures Number of engines making trips on passenger during that time was 59,184. Number of engines making trips on freight, 172,650, of this number 333 delayed trains on account of failure to steam, 1,159 from machinery failures, and 232 by running hot

The mileage made by passenger engines for the twelve months was 8,400,000, freight engines, 15 600,000, making a total of 24,000,000 miles in the twelve months. This does not include mileage made by switch engines or engines in work-train service.

We have before us the twelve monthly statements, from November, 1892, to November, 1893, and select one as a sample. Its summary shows the responsible officer at a glance *where* he is having the most engine failures, what proportion of the engine service it amounts to, whether freight or passenger, and *what* is giving trouble; thus means can be supplied to remedy defects.

It is shown that here, as everywhere else, breakage to machinery causes most of the engine delays; and that trouble from this cause is not greater when the diversified styles, kinds, makes and ages of engines is taken into consideration, is a wonder.

It is plainly shown that speed has much to do with engines running hot, for the percentage of "hots" on passenger engines is three times as great as on freights, while trouble from "not steaming" seems to be about equal in both branches of the service.

The U P. system of tracing and keeping a record of engine failures is to be commended In the first place, there is no lying of train or engine men, the conductor does not "cook up" a reason for delay—"not steaming" being the easiest. Any delay to a train of five minutes is reported to the superintendent of car service, who daily reports to the general manager the engine failures—on what division they occurred, when, what train and what engine.

The general manager sends to the superintendent of motive power an inquiry blank, giving the delays to all engines for the day.

The superintendent of motive power sends a special inquiry blank to the division master mechanic, who gets a written report from the engineer.

If the trouble is something the division master mechanic can rectify, so much the better, but he adds any information he has, and the report of cause goes to the superintendent of motive power—the man that applies the remedy, if he can find it. A record is made, and then all the papers in the case are filed together, and form a history of every failure.

It is remarkable how much this kind of a record keeps down petty failures. Men try not to go on record with a failure.

When you come to send out between six and seven hundred engines a day for a year, a total of 231,834 trips, making an an annual mileage of 24,000,000 miles, with *less than three-fourths of one per cent.* of engine failure, where they count everything a failure, it is a record to be proud of.

UNION PACIFIC SYSTEM.

Comparative Statement by Divisions of Delays to Trains caused by Engine Failures, as Reported by Supt Car Service to General Manager.

Month of January, 1893.

PASSENGER TRAINS.

DIVISION	No. of Engines in Daily Service	No. of Engines in Service during month of Jan'y, 1893	Percentage of Failures to No. of Engines in Service during month	STATEMENT OF FAILURES: Not Steaming	Mach'y Failures	Running Hot	TOTALS	Percentage of Failures
Nebraska	44	1,364	$1\frac{4}{10}$	1	7	11	19	34
Wyoming	26	806	$2\frac{2}{10}$	3	12	3	18	32
Kansas	17	527	$1\frac{3}{10}$	1	3	3	7	13
Colorado	21	651	$\frac{3}{10}$	2	0	0	2	4
Idaho	27	837	$\frac{1}{10}$	0	1	0	1	2
Utah	10	310	$\frac{6}{10}$	0	2	0	2	4
Pacific	18	558	$\frac{7}{10}$	0	3	1	4	7
Fort Worth	7	217	$\frac{9}{10}$	1	0	1	2	4
TOTALS	170	5,270	$1\frac{1}{10}$	8	28	19	55	100

FREIGHT TRAINS.

DIVISION	No. of Engines in Daily Service	No. of Engines in Service during month of Jan'y, 1893	Percentage of Failures to No. of Engines in Service during month	Not Steaming	Mach'y Failures	Running Hot	TOTALS	Percentage of Failures
Nebraska	84	2,604	$1\frac{2}{10}$	7	23	2	32	24
Wyoming	110	3,410	$1\frac{5}{10}$	4	46	2	52	39
Kansas	60	1,860	$\frac{5}{10}$	0	9	0	9	7
Colorado	97	3,007	$\frac{7}{10}$	5	14	2	21	16
Idaho	81	2,511	$\frac{2}{10}$	0	4	1	5	4
Utah	14	434	$\frac{0}{10}$	0	0	0	0	0
Pacific	64	1,984	$\frac{3}{10}$	0	5	1	6	5
Fort Worth	20	620	$1\frac{0}{10}$	2	4	0	6	5
TOTALS	530	16,430	$\frac{8}{10}$	18	105	8	131	100

PERCENTAGES	Passenger	Freight
Not Steaming	14%	14%
Machinery Failures	51%	80%
Running Hot	35%	6%
TOTALS	100	100

J. H. McCONNELL,
Supt. M P. & Machinery

Omaha, February 20, 1893.

Car Construction and Collisions.

"The trouble in getting up devices for insuring safety in collsion is that when we get into a collision the things never behave the way that we figure on We can build a car with a bottom of solid steel, it will make a nice, heavy battering-ram when it happens to get above the platform of the car ahead of it and the car ahead stops suddenly—it will go right through. You can build the sides of solid steel, if the two cars happen to get a little six inches out of the line they are going into each other, and the heavier you make them in cases of that kind the further they will go. Now, any one who has observed the telescoping of cars, has found that it is not the floor and the sills, and very often it is not the sides that give way It is the ends; and those cars, instead of keeping in line with each other as we figure on and build them to do, get a little to one side and in they go, and clear out the whole inside of the car. Any one who has had a few years' experience on a railroad knows that I have seen cars telescoped with the platform almost intact. How the other car got up there I don't know, but it got there, and I am inclined to think that the excessive weight of cars is a greater threat of danger to us to-day, in the matter of collisions, than almost anything else

"Now, instead of looking at a train, the track, the engine and all the cars, as a machine, and designing the different parts of the proper strength, what do we do? One party makes the track, another makes the locomotive, another makes the coaches in the front of the train, another makes the sleeping-cars in the rear of the train, and taking the whole thing, I do not believe we could get up a better machine for killing people in case of collision than what we have now It is really a fact, and until we take the whole thing into consideration and work out the thing as a whole, I do not believe that we will make any improvement. We may patch plates of steel on here and there and brace it up, and so on, but we will never get a reasonable freedom from telescoping and difficulty of that kind in collision, until we take the thing as a whole and work it up in that way."

The above remarks were made by Mr

J. N. Barr at a meeting of the Western Railway Club. The purpose of the remarks is to raise objection to the introduction of steel in car construction. In doing so, we are afraid that our friend Mr. Barr has taken an untenable position. It is all right to hold that the strengthening of the train should be taken up as a whole, but the difficulty is that the different interests that take a part in building the cars for a through train cannot be prevailed upon to work together for common good.

This being the case, it becomes the duty of the individual railroads to strengthen their own cars so that the people they carry will not be crushed in any accident that may happen.

It is perfectly true that a heavy, strong car will act as a battering-ram upon weaker ones, but that is no argument against the sound principle that a strong car is safer for travelers than a weak one, and that there is no material too strong for car construction. The same argument there employed applied with much stronger force in the days of cross framing, light platforms and loose couplers. The companies owning cars of this character objected to the use of the Miller platform on the grounds that it would crush through the weaker cars, but the battering-ram platform forced its way into favor, and the vicious forms of construction which brought forth weak cars had to go out. In Europe, where the Pullman cars are liable to crush the weaker compartment cars in a collision like eggs, it is bad for the weak cars to have Pullmans beside them, but travelers are not exclaiming, "Banish the battering-ram cars!" They are demanding day cars as strong as the Pullmans.

We suspect that the progress towards the use of steel in car construction will not be retarded by any fear that in case of accident the steel structures will crush those of wood. In the early days of railroading in this country, when passenger cars were structurally weak, the most disastrous accidents were due to the crushing of the cars. This source of danger has been materially eliminated by improvements in car construction, but the car is yet by no means perfect in this respect, especially for the high speeds becoming common. When trains are run at a very high speed it is inevitable that they will occasionally be brought to a sudden stop by striking unexpected obstructions. When this happens the strength of the car must be relied upon to save the lives of the people inside. Steel cars of a given weight will resist severe shocks much more successfully than those of wood; and this is a good reason for the introduction of steel in car construction. Patching the ends with plates of steel, and binding the framing with the same strong material, have already made cars stand shocks with impunity, which would have been fatal to a weaker structure. We feel certain that the teaching of experience is in favor of the strong material.

An Old-Time Broad Gauge Mill.

The ancient and honorable citizen whose portrait is here shown was a famous engine for speed on the old Hackensack & New York road, now a part of the New Jersey & New York.

The "Hackensack" was built by the Rogers Locomotive and Machine Works in 1860, and for many years hauled passengers, until ruled off the course by the narrowing up of the line. Her principal dimensions were:

Gauge of road, 6 ft.
Fuel, bituminous coal.
Cylinders, 9 x 16 in.
Diameter of driving-wheels, 5 ft.
" " truck-wheels, 26 in.
Style of boiler, wagon top.
Diameter of boiler, 34 in.

Firebox fitted with combustion chamber 24 in long. Smokestack had a "variable cone," operated by levers from cab, as shown. The engine was fitted with Loughridge air-brake. Her eccentrics were on the axle, between the firebox and the driving-box.

Taken altogether, the "Hackensack" was a queer-looking passenger locomotive to be built for service as short a time ago as 1860.

Doctor Skeever's Sure Cure for Throttle Fever—Shake Well Before Taking.

Jim Skeevers don't always confine his object lessons to the firemen, sometimes he works one off on other engineers, the foreman, the master mechanic, or the superintendent, and he has been known to illustrate a point to the fourth vice-president.

One of Skeever's object lessons converted an intolerable nuisance of a roundhouse foreman into a reasonable human being, and, if there is anything in the doctrine of perdition, saved the souls of a lot of men who were before prone to blaspheme every time they talked to the hereinbefore mentioned foreman.

This foreman was one of those restful mortals who make you feel satisfied with your lot, when you kick about cylinder packing that blows, valves that leak, or rods that pound, by telling you how much worse some other fellow's is—this helps yours so.

He was one of the kind that sneers at everything the engineers do on the road in an emergency, and tell what they ought to have done.

The kind that kick about giving orders for the little engine supplies as if he had to pay for 'em.

The kind that scratches off *all* the work put on the book if he does a little of it.

One of the kind who believe in "good enough" jobs.

One of the kind who are always wanting to get out on the road to run—and has never done any running, or firing, *eyether*.

Skeevers laid for Davidson for over a year, and finally got him. Davidson had been wanting to ride over the road with Skeevers the first Sunday that he went out in the morning. So he got him alone last Sunday. Skeevers was marked up for an extra freight at 8 40.

Skeevers' engine had been double-crewed all summer, on account of World's Fair business, and running repairs were cut down half on account of the engine being out most of the time, and another half on account of the reduction of shop force and a 10 per cent. encourager for shopmen to do as little as possible.

Skeevers don't kick much, as a rule, but when he reported, "Right check ground in and cylinder packing down on the right side," trip before last, he felt sure the engine couldn't do her work much longer without it; but when Davidson told him he "ort to hear Jim Bishop's engine blow," and that "Baldy Bates' fireman got out on the running board with a pail of water and the coal pick every time he shut off the injector," Skeevers said that he hadn't noticed it, and perhaps the "618" was all right after all, but she needed washing out awful bad, anyhow.

Davidson laughed. "Lord," said he, "Dave Keller's had the '96' on the express for four months without washing. Dave is a good man with an ingin, you know," he added parenthetically, "machinist runner, too; he doesn't shut off on the road at all, jest run her on froth—soda water."

Skeevers was glad he was going to get that extra Sunday morning. It would surely be empty coal cars—about two more than the engine ought to have. He knew the road would be crowded with trains—there's no God on the railroads.

He knew Davidson would go out with him—and Skeevers smiled.

Skeevers called on the train dispatcher who would be on duty the next day, talked a few minutes, and—they laughed.

Skeevers hunted up Billy Woods, his conductor, they had a cigar, chatted a few minutes, then, well—they laughed real loud.

Davidson came down the next morning smiling—going to have a holiday. Skeevers got around later, got into his overclothes and commenced to oil around. Billy Woods came by and gave them both a cigar, remarking to Skeevers that they were going to be four loads short of a full train (they had three too many), and that the "618" would just play with the train—sure to have a nice easy trip.

Pete Doyle had a cushion on his seat for the foreman, and let him have the window all to himself and be right in his way—Pete knew it wouldn't last all the trip or he'd have kicked lustily, and who could blame him.

As Skeevers dropped a little 13 cent oil on the well worn bearings of his engine Davidson followed him around and Skeevers "jollied" him a little.

"Been runnin' you pretty hard lately, 'aint they, Skeevers?"

"Well, yes, tolerable, but then, you know, we get paid for it, I got in fifty-one days last month."

"Fifty-one, four times fifty-one, by George that's $204! The old man only gets $150"

"Yes, but he's just a master mechanic, you know," said Skeevers in a pitying voice which made Davidson's $90 a month seem measly and small. "Pete gets almost as much as that. I've often wondered why you didn't go out runnin'—a man like you 'ort to be makin' decent pay—the idea of bein' tied down to a roundhouse is hard lines. Running is pleasanter, better paid and less responsibility, and, knowin' as much about engines as you do you 'ort to get a great reputation on the road, some of these ducks don't know no more about an engine than I do about preaching," Skeevers knew he tickled the governor in the right place there.

"Well I sh'ud say so. Why Giles come in last night with the piston blocked wrong and the—

"Here's your orders Skeevers," said the conductor, and holding up one, read

"Run to Junction City extra. Trains 21 and 107 are abandoned. Don't pass Hope without orders. You may use fifty minutes on the time of No. 8, Cole conductor. Meet light engine, Smiles', east at Preston."

Skeevers and Davidson swung up into the cab, and, after comparing time with the conductor, the 618 commenced to cough and wheeze getting the train started. The packing in the right hand cylinder roared lustily and, though Skeevers was used to it, he cocked his ear and pretended to listen—Davidson listened too.

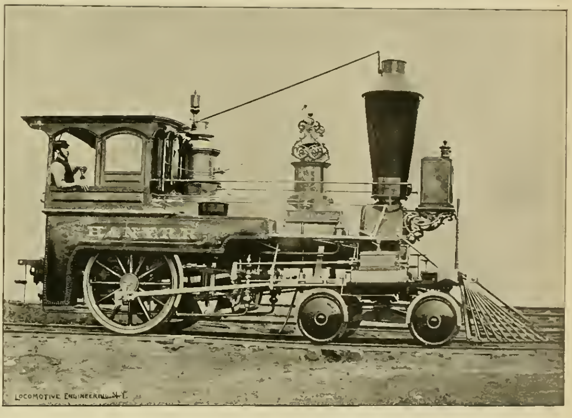
"When did you clean her nozzles, Skeevers?"

"Yesterday."

"Got a funny sound in one, guess the tip is loose on the stand."

"Nozzles be damned" said Pete Doyle, "thot's one ave the jobs Skeevers has asked youse for the doin' these many times, avery turn ave her wheels means a shovelful of coal tor mesel to sling. I never heard cylinder packin' blow the equal ave thot."

"That ain't her packin', is it Skeevers?"



THE "HACKENSACK"—AN OLD-TIME BROAD GAUGE MILL.

"Yes, but that's nothing—you o'rt to hear it blow on Jim Bishop's engine!"

Then he whistled for a road crossing to keep Davidson from answering.

They were not ten miles from home when they had to stop for hot pin on the left side.

"Maybe you've got her keyed too tight," suggested Davidson.

"No, it's the main rod and it pounds itself hot."

They looked at it, and, sure enough, it was awful loose on the pin. Davidson offered to file it right there, and promised to do it in ten minutes. Skeevers led him on, looked at his watch, and said if it could be done in fifteen it would be all right.

They had to cool the pin and strap, then take it down. Skeevers had a file, but no tools except the regulation set, and they had trouble in getting the strap off the rod and more trouble to get the back half of the brass out. Then there was no place to hold it and nothing to square the brasses by or with. Davidson had his store clothes greasy by this time, and was in a good sweat, hard at work, when the conductor came up and wanted to know why in the blankety-blank they didn't overhaul the engines in the shop, looked anxiously at his watch, ordered the head brakeman to run and flag No. 2 (which wasn't due for an hour), and made a howl in general.

When the main rod was up again they had not time to make the next town for No. 2, so they backed up and headed in. When they got to the next telegraph station there was a fierce message about the hour and forty minutes' delay.

Skeevers wrote a bland explanatory message, and the reply came over the wire that whoever caused that delay would hear from *me* on Monday. This was signed by the superintendent, and it made Davidson very ill at ease.

The next twenty-eight miles was level or slightly down grade, and Skeevers seduced Davidson over to his side, and finally got him on his seat and hold of the throttle. This was all very nice for half an hour, and Davidson was getting a little confidence in himself. Skeevers went over on Pete's side and sat down, and in going had hooked the cab door behind the new runner.

The "618" commenced to work water, and Skeevers remarked that she was full and the injector had better be shut off.

Davidson shut it off. The check stuck up, there was a growl, and in just one second the boiler of the "618" commenced to blow off through the overflow of that injector, and the new engineer was trying to get out of the side window. Skeevers was there and stopped him.

"It's the check stuck up," he yelled, "go out on the running board and pound it. I'll hand you a pail of water."

Davidson got a shower bath getting by that overflow, for he didn't think to shut it, and let her blow into the tank he'd thought of that in the shop.

When he was half way out to the check Pete pulled the whistle open, and he came back in a hurry and shut the throttle. Then Skeevers opened it as he handed out a pail of water. Davidson dodged back again, thinking it had worked open. Finally he hammered and cooled the check into taking its seat.

Davidson was wringing the water out of his vest and swearing, when Skeevers made it all right he told him about Baldy Bates' engine, and how *her* check stuck.

Davidson made up his mind to get back on the fireman's side. But when he looked around for Skeevers, he was back on the first box car, with his legs hanging over the side talking to the brakeman, and Davidson had to "keep her a going."

Pete watched his chance, and when Davidson whistled he started the left hand injector it was level and easy for the next two hours' run, and Davidson never thought of the injector again.

Presently, Skeevers came over, and the first thing he asked was if the check stuck up again.

"No, ain't used it."

"How's your water."

Davidson's face was ashy white in an instant, and his hand trembled as he reached for the lower gauge-cock; it reddened when he found water.

"Haven't you put any water in her for the last two hours?"

"Not a drop—she don't use much, does she?"

"Misther Skeevers," said Pete, "its mesel youse can thank for the wather. The boss av the roundhouse is hell on runnin' engines as is standin' still—if Pate Doyle hadn't put on his squirt, youse wud a had the mud ring melted aginst now."

Davidson tried the gauge-cocks every two minutes all the rest of the day.

When they stopped at Slocum for water, Skeevers found use for the soft hammer and asked Pete for it.

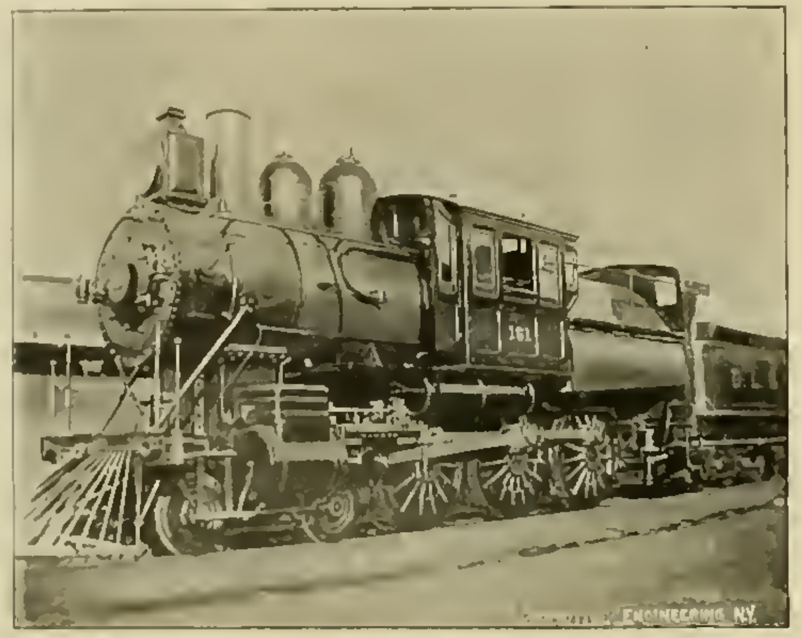
Pete looked all through the box and reported a drouth of soft hammers.

"Oh! It's there. I saw Davidson get it to pound that check."

"In coorse ye did, sorr, and he left it on the runnin' boord and it's jiggled off entoirely."

"And it's lost."

"Gone till the divil, an' it's himsel' as stud up on his hoind legs and cursed me.



HARD COAL STACK BURNER, D., L. & W. RY.

Pate Doyle, for bein' thot kerless as to drap aff the lasht one. He sed he'd never give you nor me another soft hammer so long as the Lord left him wind to breed wid."

Davidson couldn't help hearing, but he laughed and said he'd give Pete an order for a new one.

Skeevers gave Davidson his orders, made him read them, and told him to go ahead —he was going back to the caboose.

Just as they struck Hope yard, Pete slyly let down the right tank valve, gave the lazy cock of his injector a quiet kick, and it broke. He told Davidson that his injector was "kicking up" and that he'd better start his own. Davidson tried. The more he tried, the more excited he got. Pete told him to unhook the door, and he would show him how to start it This was humiliating. Of course it started all right for Pete

They were sailing right through the little town, when, all at once the emergency went on (from the rear), and as Davidson pulled his head out of the front sash he looked back, and the conductor, Skeevers, and both brakemen were flopping their wings like windmills.

"Are ye tryin' to kill everybody, ye crazy loon?" yelled the front brakeman. "Gimme a red flag, quick, Pete."

Skeevers came over on a run, and pushing poor Davidson out of the way, backed the engine inside of the switch limits.

"What's up, for God's sake?" asked Davidson.

"Up? Why didn't you read them orders. '*Don't pass Hope without orders.*' It's a sure discharge for going by a 'do not,' besides we might a had a collision."

Davidson got over on Pete's side, and Skeevers had to run her in, and they got along all right.

At the end of the road they got supper, and Skeevers proposed a walk around town before they went to bed; but the caller came for them before they could get away, and at nine o'clock the "618" was hooked onto a row of freight cars up in the big yard.

Skeevers got Davidson on his side to "learn him the yard," and with all the switch lights and switch engines dodging out and in, and the signals from three crews, the whistling and answering whistles, Davidson was a little muddled. Maybe Skeevers made some extra moves, got some extra signals, and done some extra whistling, but it all served to mystify Mr. Davidson, and to increase his respect for the engineer who understood it all and was so cool about it.

That night, going down, Davidson learned that he couldn't handle automatic air nearly so well on an engine and a grade as he could in the roundhouse.

He learned how pleasant it was to put the reverse lever down in the corner, and skin the knuckles in doing it.

He learned how much it helped to keep one awake by putting a red hot steam-pipe just under the throttle-lever—just where the wrist will touch it if the arm is allowed to sink a sixty-fourth.

It rained, and he learned something about handling a big train in bad weather on both sides of a hill.

Skeevers illustrated in several ways, without saying so, that it is impossible for an engineer to do much "keeping up" of his engine on the road and handle his train on time.

Davidson was nervous about fires along the track until passed; he got excited over some horses that got on the track and got hit.

He learned what it was to "hustle," and be "hustled" by every man with authority to send a message.

He learned what it was to stay on a freight engine for twenty-four hours without rest, and without a lunch pail. Skeevers longed to make it thirty-six, and then tell him that Swifty Wilson once ran fifty-four hours without rest—always sprung on a man who kicked about *doubling* the third time.

At Junction City, Skeevers went into the office for orders, and asked Davidson to "make a switch" for him. The crew got him into a cut-off with forty red lights in sight, all of them made signals at once, both ponies whistled at him, the check stuck up, and he burnt his hand all at once—and backed off a switch to boot.

He was down with a lantern looking at his "luck," all the switchmen were cursing the air blue, and the "618" was blowing off wildly when the conductor came down with an order for him to run engine "618" into the terminal, as Skeevers was wanted to run Carlton's engine west, Carlton was sick.

Davidson's heart was faint when he thought of the eighteen miles of down hill ahead of him, and that pesky automatic that he knew so well how to *tell* others to use, but could not seem to *show* the how very successfully, besides that the "618" was off the track.

He was more at home getting her on than running her. He looked her over carefully and yelled up to Pete to bring the "blockin'."

"We ha'nt got no blockin'."

"Well, get out the jacks."

"They've all been took off, sorr."

"Say, neighbor," said the conductor, "do you think we've got time to raise this engine up on jacks. She's a blockin' the main line. Git up there, Pete, and when I say 'when,' give her the tit."

He ran around the engine, threw in a couple of links here and there, and—said the "when."

Pete pulled her open; there was a great fuss and wiggle and slip and shake—but she got on all O K.

"That's the way to do business—on the road," said the con.

They got home at last. Davidson sent word to the roundhouse that he wasn't able to come down, and went to bed, but he asked that the "618" lay in and have work already reported done.

The next day as Skeevers was packing the throttle, a helper, working on the rods, struck Davidson for a job of firing.

"You're a fool, young feller," said Davidson, "why don't you finish your trade?"

"The firemen make more money than most of the machinists do. I've worked three years at it now, and that ought to help me about gettin' promoted."

"Well, they earn it. Why, confound it, man, they don't eat regular, nor sleep any to mention; and as for your machinist experience helpin' you, why, it ain't worth a damn. They ain't supposed to repair engines on the road, and any fireman on the division can give *me* points about fixing up a breakdown. Running an engine is a separate trade, sir, a separate business. An engineer don't know much about putting in springs and facing valves; but don't think he don't know nuthin'. There's just as much difference between the machinist trade and engine-running as there is between diamond-cutting and sausage-stuffing. Why, I wouldn't run the best engine this company's got for fifty dollars a day. It takes a different kind of man from me or you either. You go on and line them guides, and thank the Lord you ain't gettin' four dollars a day on an engine, and earning twelve."

Some of the railroads in the West, where gravel and stone are scarce, have been ballasting their tracks with burnt clay, which is popularly called gumbo. This material costs nearly as much as broken stone and more than gravel, but it makes a very unsatisfactory ballast. It is very good when first put in, is clean, fairly free from dust and easily handled, but a few years' exposure to the weather brings it back to its original condition of clay. As soon as this material begins to disintegrate it lets the track down badly, and is harder to keep up than gravel. A roadmaster who has had charge of a division where gumbo has been largely used said that the material did not stand up any better than prairie black earth.

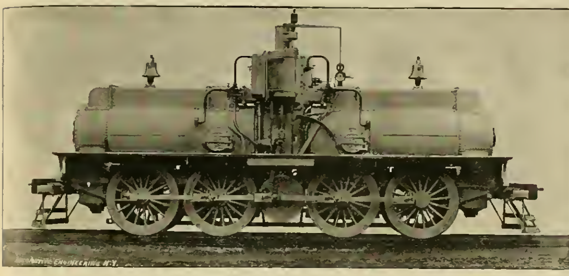
The interests in the Wadley Continuous Drawbar Co. have been purchased by the Gould Coupler Co.

The Raub Locomotive Works and Farm Land Improvement Schemes.

Ever since we said something about the Raub locomotive, that was construed to infer that we did not believe that it was the coming locomotive, "the boys" have wanted to know "what sort o' a lookin' critter is she anyway?" So here is a bird's-eye-view of the great American junk-shop on wheels.

One picture shows her before her water tanks and coal scuttles were mounted and the other shows her complete and ready for the road—one can just imagine her craw-fishing between here and Chicago at the moderate hustle of 100 miles an hour—in one's mind.

You see how the two small boilers are



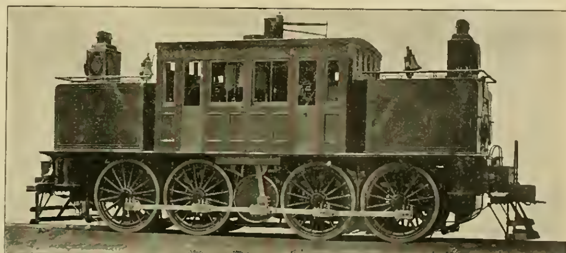
Raub Locomotive without Tanks, Cab and Coal Bunkers

fed up and the engines located; how a smoke flue runs along the top of each boiler and forms a single stack in the center. How the four fire-doors are arranged, and, perhaps, have wondered how a man was going to fire the thing.

Words simply grate on the ear; a good look at the two pictures is enough.

Only one of these hybrid what-is-its have been built, and that is hibernating in a shed at Paterson, N. J., and has been for a couple of years.

There are going to be several *works* built to turn out these locomotives, and sell land and stock—mostly stock. The Raub people just sling building sites around loose. The last place to subscribe something like $50,000 and donate land in order to get these works was Mayville, Cattaraugus Co., N. Y.



Raub Central Power Locomotive Complete.

Some one, with no regard for the feelings of the Raub locomotive people, showed them a copy of Locomotive Engineering in which reference was made to their mechanical contraption, and we are told that the inventor and father of this central-power stock scheme stated that the reason we attacked his invention was that we at one time tried to get money from him for exploiting his device, but that he sternly refused to be blackmailed—hence these tears. All of which is just as true as the statement that his device is a locomotive capable of doing useful work. It might be worked as a sorghum mill, but the greenest boy in Cattaraugus County wouldn't ever mistake it for a locomotive—not for a minute.

A Valuable Test of Hydraulic Riveting.

In the Baldwin Locomotive Works they have very powerful hydraulic riveting machinery. In using these riveters a question came up to the effect that the work or material might be injured by the pressure used being too great. To obtain some information on the subject, Mr. Vauclain made seven assortments of cuttings from steel sheets $\frac{7}{16}$-inch diameter, six pieces in each lot. These he drilled to take a row of rivets of sizes varying from $\frac{5}{8}$ to $1\frac{1}{4}$ inch. The rivets were driven in one assortment at 25 tons and in succession, the others at 33, 50, 66, 75 and 100 tons. The rivets in the last lot of plates were driven by hand. The pieces were then milled down through the center of the row of rivets and etched with acid. It was found that when the higher pressures were employed upon the smaller rivets that the sheet around the rivet was distorted. An examination of the condition of the plates and rivets showed just what pressure could be best applied to make the rivet fill the hole solidly, and at the same time not spring the sheet. The hand-riveting filled the holes very satisfactorily. On the larger rivets the pressure of 100 tons could be employed without doing any damage to the sheets. At the same time the large rivets were driven so perfectly that scarcely a line distinguished the juncture of rivet and sheet.

High Uses for Whistle and Bell.

"It is funny the uses the people of Peru find for some railroad appliances," remarked W. W. Thompson, at the last meeting of the Flat Wheel Club.

"When I first went to Peru I took a Rogers locomotive, the first American engine ever seen in that part of the country. They had nothing but English engines before that, and the Yankee, as they called my machine, excited amusement and prejudice. They all predicted that she would be knocked out in no time by the solid-looking English locomotives, but the knocking out was entirely the other way. She could pull the ends off the others and not feel the wrench besides, she worked along, day in and day out, without repairs, while the others were in the shop half the time. The English engines had small squeaking whistles, but the Rogers had a roarer that frightened the natives. You should have seen how they took to the woods when I opened that whistle. One day I passed a procession of mules with leather sacks of water on their backs. About the time I was opposite them I wanted to whistle and opened her out. For a minute the air was black with water bags, Peruvians, and mules' heels. When the dust cleared away the road looked like a battle-field, but every last mule was making for the timber.

"The superintendent paid no attention to the complaint made, but it struck him that he could use the Rogers whistle elsewhere to good advantage. The natives were sleepy and lazy, and nothing could rouse them in the morning. So he took and put the whistle in the shops and rousted out the sleepers with it. It worked all right for a week or two, but the natives soon got so that they would slumber as peacefully through the tune played by that whistle as they would under the notes of a guitar.

"The engine bell was a novelty and declared to be a useless nuisance. It was taken off and consigned to the storehouse. Its fame had, however, spread through the country, and many applications came in from churches for the donation of the bell. It was given to one of the most influential of the applicants, and was hung with imposing religious ceremonies. That Rogers bell is now the pride of the region, where it is daily heard calling sinners to prayer."

The Lehigh Valley strike has been settled. Both sides lost. The company has lost hundreds of thousands of dollars in machinery destroyed and business driven away from the road, have many incompetent men on their trains and engines, and the public is afraid to ride over the road. The most of the men are out in the cold, without employment, and some of them without suppers. Several lessons have been learned, however, and these may, in the end, be worth the price paid. One of them shows to what ends an overbearing official may carry things. Another shows how useless and expensive a strike is, and forces home the question, "Isn't there some other way?" Another lesson well learned in this strike has been how useless was the combination known as "system federation." The lessons will be bitter ones to many of the men—and the Lehigh Valley Railroad are not anxious for another fight. The whole thing is to be deplored, take it from any standpoint you may.

The Illinois Central Railroad Company has been the object of inveterate attacks lately by some Chicago newspapers, which object to the system of fences and turnstiles introduced for World's Fair traffic and still retained. These fences and turnstiles keep people off the track and out of the stations, and are safeguards badly needed on other railroads. That a railroad company should be abused for practices which insure safety and prevent intruders from trespassing on track and stations, is a curious commentary on the ignorance and intolerance of those who raise objections.

The engineers and firemen of Victoria, Australia, have been agitating against running trains on Sundays. The grievance committee on that end of the globe becomes a deputation. A deputation waited on the minister for railways to protest against running Sunday trains, and they were told that they held the remedy in their own hands, as there was no law compelling the men to work on Sunday. He intimated that refusing to go out on Sunday would stop the practice.

The Government of New South Wales have been extremely liberal in providing transportation for politicians, but there is now a strong inclination to treat politicians as if they were made of common clay. A statement was made lately that the abolishing of special street cars and trains for assemblymen would save the colony $50,000 annually.

The Missouri, Kansas & Texas, the Boston & Albany, and other railroads that are using Miller's Asbestom roof for cars speak very favorably concerning various good points possessed by the roof. The material is remarkably tough, it is easily applied, and the indications are that it will last during the entire life of a car. The roof is handled by Mr. H. R. Miller, Havemeyer Building, New York.

LOCOMOTIVE ENGINEERING

A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER AND ROLLING STOCK

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We have made arrangements to send the Educational Charts from a point in Canada, and *without Customs charges or trouble* to you. Send in your subscription and you will get the charts by mail all free.

Decision of the Air-Brake Suits.

In our last issue we briefly mentioned that the suits brought against the New York Air-Brake Company by the Westinghouse Air-Brake Company, for infringement of the latter company's patents on quick-action brake mechanism had been decided in favor of the complainants. Since that notice was written we have been able to study the text of the decision, and find it to be so conclusive and wide-reaching that it will be impossible for other companies to manufacture quick-action air-brakes during the life of the Westinghouse patents.

As many railroad men entertain an erroneous impression about what the Westinghouse Air-Brake Company have done for quick-action brakes, we will briefly outline the history of this invention. About 1884, when many railroad companies were contemplating equipping their freight cars with continuous brakes, a committee was appointed by the Master Car Builders' Association to investigate the subject of "automatic freight car brakes" and report on the same. When the convention met at Old Point Comfort in the following year, a report on the subject was submitted which gave particulars of the progress of applying power brakes to freight cars and the kinds of brakes that were being offered to railroad companies. These were classified as: 1, buffer brakes; 2, friction brakes; 3, air brakes; 4 electric brakes. The committee recommended that a series of tests should be made to ascertain the comparative efficiency of the various brakes offered for freight service.

These tests were made on the Chicago, Burlington & Quincy Railroad, near Burlington, in July of the following year. A variety of conditions were prescribed, the most important one being that brakes must work on trains of fifty cars, and make service or emergency stops without causing dangerous shocks. A number of brakes entered the trials, the Westinghouse automatic brake among them; but none of the brakes stopped long trains quickly without causing severe shocks, which could not be tolerated in service. The trials were a failure, except that they demonstrated that machine brakes were worthless for handling long trains.

The Master Car Builders' Association then arranged for a second series of trials, which were carried out at Burlington in 1887. In the meantime, Mr. George Westinghouse had set himself to work to invent a brake, the action of which should be so rapid that it would apply all the brakes on a long train almost simultaneously, and thereby prevent shocks. The trouble with the plain automatic brake was, that it acted so slowly on a fifty-car train that in an emergency stop the brakes on the front cars stopped that part of the train before the brakes on the rear cars were applied, and the rear cars struck the front ones with destructive blows. In his labors to produce a brake that would remedy this defect, Mr. Westinghouse devised and patented his first quick-action brake. It was tried at the 1887 tests, but was not satisfactory, although it was much superior to the old automatic brake. Several air-brakes were tried in the 1887 tests which had their triple-valves actuated by electricity, and they all handled fifty-car trains very smoothly and satisfactorily.

The teaching of the 1887 trials seemed to be, that the use of electricity was necessary to actuate air-brakes on very long trains, and the Master Car Builders' committee came to that conclusion. When the trials were finished, almost every expert who had witnessed the experiments, or studied the subject, was forced to believe that the use of electricity was the only alternative for operating brakes on fifty-car trains. Railroad men were very much disquieted over the prospect of having power brakes complicated by electrical apparatus.

Mr. George Westinghouse was an exception in clinging to the belief that the air-brake could be made to work with sufficient rapidity to handle a fifty-car train smoothly. While the experts belonging to other brake companies were devoting themselves to the perfecting of electrical mechanism for actuating the triple-valves of freight brakes, he directed his inventive energies anew to the air-brake pure and simple. The first quick-action triple valve was an important step forward, but it was not considered satisfactory, although with enlarged passages it was found capable of meeting the conditions laid down by the Master Car Builders' Association.

With the plain automatic brake, the reduction of air pressure necessary to apply the brakes, could only be obtained by the air traveling to the engineer's valve, which took too much time when the train was nearly half a mile long. Mr Westinghouse conceived the idea that he could make each triple-valve release a portion of the air from the train-pipe, and thereby secure almost instantaneous action. This was what he eventually accomplished, with the additional advantage that the air drawn out of the train-pipe for emergency action was passed into the brake cylinder. The invention by which this extraordinary operation was accomplished was perfected in the second quick-action triple-valve, which was covered by two patents. The complete invention of a quick-action brake was covered by three patents, and according to the words of the judge in deciding the suits, each involved a separate, distinct and patentable invention and method of executing the quick action process.

The practicability of making a brake that would handle a fifty-car train safely by air alone seemed hopeless until George Westinghouse demonstrated how it could be done; but no sooner was his quick-action brake put in service than various other inventors learned the way to make imitations. The New York Air-Brake Company appropriated the most valuable features of the patents, under the plea that the patents were not valid. The counsel for this company labored to convince the Court that, if the validity of the patents was established, it would prohibit all competitors of the Westinghouse Air-Brake Co. from manufacturing a quick action brake. As the validity of the patents have been sustained, the likelihood is that the prediction of the defendants will be fulfilled, for we cannot see how quick-action brakes can be made without infringing the broad claims allowed.

The brake case is easily stated. The railroad world was urgently demanding a brake to perform functions of an extraordinary character. Experts and inventors looked on hopelessly, and protested that railroad men were asking for an impossibility. George Westinghouse set to work and converted the impossible into practical mechanism. When his wizard-like work was accomplished, the lesser spirits tried to appropriate the product of his genius. The courts have declared that the invention shall be the property of the inventor; they have said that the quick-action brake is an original and meritorious invention. It marks a step in the improvement in brake appliances as important as that made by the automatic brake when the latter took the place of the straight air-brake.

We consider that railroad companies are to be as much congratulated on the decision of the air-brake suit as the company that comes off the victor. If there is any part of railroad mechanism where strict interchangeability is particularly desirable it is in air-brake apparatus. The interchangeability now prevailing would not long remain if a variety of brakes were in the market for any length of time, and the confusion which would ensue from diverse forms would fall hardest on railroad companies.

The Master Car Builders' Association have laid down very strict conditions concerning the requirements of an air-brake, in order to make the brakes of different companies interchangeable, but the conditions do not reach to a brake after it goes into service. In some tests made recently with a strange brake, which was said to work with the Westinghouse, it was found that when the latter brake went on the stranger went off. This merely gave a glimpse of the danger and confusion that would ensue, if a variety of different brakes were mixed up in trains. It would be impossible to locate with certainty the responsibility for failure, and railroad companies would be the principal sufferers.

There has been an inclination among some railroad men to divide the brake business because they did not like to encourage monopolies. Those who were striving hardest to establish monopolies in their own companies were generally the most strongly opposed to others. Those who consider the matter without prejudice are compelled to acknowledge that the Westinghouse Air-Brake Co. have been a very beneficent monopoly. To them the world is indebted for the development of a perfect system of train brakes, and the advantages of this great safety appliance have been given at small cost. The price of brakes has been steadily reduced as the appliances for cheapening manufacture have been perfected. There is no kind of mechanism sold so cheaply. When a mechanic examines the variety of accurately finished appliances that are sold for $40, he is astonished that the complexity of parts, the fine material and the precision of finish could possibly be supplied at the price without loss. Those who are inclined to fear the decision putting the monopoly of brake manufacture into the hands of the Westinghouse Company, should make a careful examination of the apparatus they purchase.

Engine Failures.

On another page will be found an interesting record of engine failures for a year on one of our Pacific roads. A road traversing the great plains, with their wind and sand storms, crossing the Rocky and Sierra Nevada Mountains, and using all kinds of water, good and bad.

On this road a bad tank of coal may be charged up as an engine failure, for a delay of five minutes for want of steam constitutes a failure.

The system of reporting failure prevents "cooked" reports. The superintendent of car service reports all delays and their causes; his delays are checked by the train-sheet. The general manager's office reports in detail to the superintendent of motive power all detentions caused by motive power; the superintendent of motive power sends an inquiry sheet, giving all detentions on his division, to each division master mechanic, and for each engine failure he must return the statement of the engineer in charge, and any notation he may think will make the matter clearer.

All this keeps the whole motive power department alert to prevent charges of "engine failures" going in, with the result that for a whole year the proportion of failures to the engines in service has been *less than three-quarters of one per cent.*

Engine failures on most roads means a break in the machinery. On the U. P. they classify failures under three heads, viz: Failure of Machinery, Not Steaming, Running Hot. Some of the remarkable records of engine failures have been made where nothing was charged against the engine but an actual breakdown, but a delay on account of steam is no less important to the road, and needs a remedy just as badly as a broken spring.

The Improved Form of the Paper.

Considerable change is made in the appearance of LOCOMOTIVE ENGINEERING with this issue. We have no excuse to offer for any of the things done—we have thought each of them an improvement.

The cover has long been needed to keep the paper clean. As most of our readers handle the paper a good deal, they will appreciate this.

All the advertising is placed behind for a special reason—to allow us to do better presswork.

When advertising pages are mixed up with reading pages it is impossible to do very fine presswork, especially where half-tone cuts are used; the ink required for the large type in the ads. fills up the fine cuts, and, if the ink is just right for the cuts the ads with heavy type are gray. We believe that the paper will be found a much better job typographically.

Another new feature will be an index of the advertisements following the reading matter. We shall continue as we have agreed, to always furnish at least twenty pages of reading matter, and we shall feel at liberty to increase or decrease the number of advertising pages according to the business.

With the paper for 1894 will be sent three Educational Charts, all about which our readers have probably found out. This is a popular feature, and is increasing our subscription list fast.

The only thing about the paper that has not been increased is the price. We hope with all the improvements, each and every reader will be satisfied, get his money's worth, and have a Happy New Year.

Selling Pirated Articles.

Some of the companies that make steel castings have been offering to make any form of knuckle for car couplers, and holding out special inducements to railroad companies as a means of getting this business. We think that it is well to warn railroad companies that they are liable to have their fingers burned by purchasing knuckles of patent couplers made without the consent of the patentees. The knuckle is very often the part of a standard coupler which has the strongest claims for protection, and to buy that part from unauthorized makers is to beat the patentee out of his rights under the law.

A great deal of disreputable business

has been done in the making and selling of parts of patented devices by concerns which paid no attention whatever to the rights of the inventors. It ought to be distinctly understood by purchasing agents that they are running the risk of putting their companies into suits for damages when they order parts of patented articles from unauthorized makers.

If the inquiry is made it is generally found that the authorized manufacturer of a car coupler or other patented article is prepared to sell the details as cheaply as the pirates can do it. The legitimate maker has a pride in seeing that the article is of good quality and well made, while the unauthorized maker cares for nothing but the production of a thing that looks like the real article and can be sold cheaply. The men who lead railroad companies into the invidious position of purchasing pirated goods are not worldly wise, even when this mean species of stealing is not found out, for they generally pay the same money for an inferior article. We understand that one of the greatest sufferers from the pirating of parts of patented devices is quietly collecting evidence of companies which are purchasing the parts from concerns not authorized to make them. When the accumulation becomes heavy enough the offenders will find on their hands lawsuits calling for damages of amazing proportions.

Identifying Locality During Fogs and Snowstorms.

On another page an engineer tells of the common occurrence of a man in charge of an engine losing his whereabouts in a fog and learning his location only when he heard the click of a frog. An officer of the road advised him to keep a log by watching the click of the wheels on the joints, and said that was the way engineers in the neighborhood of New York kept a record of where they were in foggy weather. This is just another example of how little some men comfortably reclining in offices know about the practical difficulties an engineer meets with in certain kinds of weather. A man who advised an engineer to keep track of the mileage he was making by counting the joints would be a fine person to decide whether or not an engineer was to blame when an accident happened. The thing is utterly impracticable, even when there is no snow on the rails. We do not believe that any man ever attempted to measure speed in that way unless there was some other engineer to attend to the working of the engine.

Of course a man can tell how fast he is running by counting the joints passed over in a certain time, but experienced engineers do not require to measure speed in that way. They know about how fast they are going by the skill begotten by experience, and few of them can tell just how they know. They learn it just as a mechanic learns to push a file level. He can do this properly after he has acquired the art, but directions avail little in helping him to learn how to do it.

People who have no experience on locomotives have no idea of the difficulties an engineer labors under in a severe snowstorm or during a thick fog. On the elevated railroads around New York engineers often have difficulty during fogs in telling where the stations are, although the structures are dotted with things that are landmarks to the experienced eye. The utmost caution is necessary at such times to prevent collisions. When an accident does happen, the practical men in charge are always ready to allow for the difficulties of the situation.

The severe snow-storms encountered in some parts of the country are even more bewildering than the fog. In a prairie country, where there are no prominent landmarks, no groves of trees at the side of the track, and few cuttings deep enough to give character to a spot, it is quite common for engineers to lose themselves. The writer has very vivid recollections of a night spent toiling through a snow-storm in a sparsely settled district, where the station-houses were all alike and the track laid through great stretches of unbroken prairie. The only times we knew where we were, was when a water-tank was reached, and these seemed sometimes to be running ahead faster than we could make the engine go. The men who prate about counting the joints to identify distance ought to have been with us on that trip.

Inspectors in Contract Shops.

During the discussion at the New York Railroad Club of the paper on "Inspection of Boilers" considerable talk arose concerning the advisability of railroad companies having inspectors at locomotive and car building works to watch that no bad material or poor workmanship be put upon the rolling stock in course of construction. The statement had been made that small roads having one or two locomotives under construction, and which could not afford to have an inspector in the works, were at a disadvantage compared with richer companies, and were likely to receive inferior engines. The representative of one of the locomotive building works, speaking on this point, said "If a trained inspector on behalf of the railroad company, is sent to a shop where the work is in progress, he is evidently sent there for one of two reasons—either to instruct them how to build the boiler, or else to keep a watch on them for fear they should be dishonest and put in bad work. If he is sent there for the first reason, it seems to me that the railroad company is taking a good deal on itself to say that the inspector knows more about boiler construction than the builder. The builder has been building boilers for a large number of roads, and knows the experience of probably one hundred master mechanics. It seems to me that they should know infinitely more about boiler construction and design than the inspector. On the other hand, if he is sent to keep a watch on them, if the builder starts out to be dishonest, you may have a dozen inspectors and he will get the best of you. In fact, the worst piece of work I ever knew to be done, was done right under the nose of a trained inspector.'

One might preach a very long sermon on that text. Those who have worked in contract shops of any kind are aware that it is impossible to watch men close enough to prevent them from doing inferior work if they are so inclined. So many details are put out of sight in the process of finishing, that bad work cannot be detected until the machine exposes it by the strains of service. This is a reason why reputable builders prefer to have workmen permanently in their shops A man who has a steady job knows that hidden bad work will come back on him, and he experiences no motive to fall into the habit of producing inferior work because it cannot be detected immediately. The outside inspector is very much like a spotter, and considers that he must do something to show his authority and the reason for his being there.

Actuated by these considerations and a sense of duty he keeps a keen eye on the workmen, and a defect that would pass the shop inspector is taken up by him as cause for rejecting a finished part. This rouses the antagonism of the mechanic, and very often the latter proceeds to see how much he can deceive the inspector. When a contest of this kind arises the workman is almost certain to get the best of the other When antagonisms of this kind arise, it would be much better for his employers if the inspector was quietly drawing his pay at some watering-place or winter resort. Most of the inspectors are competent men, who understand human nature as well as the construction of railroad rolling stock, and they do no harm; but when the wrong man is in the wrong place, we do not know of any position where he can do so much mischief as acting inspector in the construction of locomotives or cars. The writer has been in the place of the workman, and has seen a whole shop conspiring together to beat an obnoxious inspector.

Judges for the Prize Designs.

We take pleasure in announcing the committee who will decide on the merits of the prize designs offered by LOCOMOTIVE ENGINEERING for the best and safest arrangement of cab and boiler fittings. The men selected stand second to none in their chosen callings, and the simple mention of their names gives assurance that the designs offered will be carefully considered and a just and honest decision made. The committee stands as follows

Jos. H. McConnell, Supt. M. P. Union Pacific Ry.

Sam'l M Vauclain, Supt. Baldwin Loco. Works.

W. F Dixon, Chief Draftsman Rogers Loco. Co.

Chas. H. Hogan, Traveling Engineer N. Y. C. & H. R. Ry.

Sam'l D. Hutchins, Engineer C. C. C. & St. L.

Please send in your best ideas. These gentlemen shall say which ones are the best, and we will do the rest.

We have no bound volumes or back numbers for 1892. We have no four years in one of the old paper, but will have loose copies until February 1st, and no longer. We have a few bound volumes for 1893, and a few extra copies of the last six months of the year—nothing else. Within a month there will be no back numbers of LOCOMOTIVE ENGINEERING *in any shape*, for sale, except those for January, 1894.

BOOK REVIEW.

ADDRESSES DELIVERED BEFORE THE WORLD'S RAILWAY COMMERCE CONGRESS Published by the *Railway Age and Northwestern Railroader*. Chicago. Price, $2.00

This is the official report of this "Congress" that met in Chicago in June, 1893, and contains upward of thirty addresses by the many able speakers who took part in the great meetings, and these addresses are on almost every subject connected with railroads. It is very interesting and well worth the price asked.

We understand that Mr. C. A. Hammond, superintendent of the Boston, Revere Beach & Lynn, has resigned. Mr. Hammond is an ideal superintendent for a road where that official to has manage every detail of operating and do the greatest possible amount of work at the least possible expense. With ordinary management, the road would have fallen into the hands of a receiver long ago, but Mr. Hammond fostered the business so skillfully and ran the road so cheaply that he always got both ends to meet and have a little over. If Mr. Hammond does not receive a good appointment soon the directors and presidents of railroads are blinder than we take them to be.

One of the most accomplished electricians in the country, a man of affairs and one who has had large business experience and success in the same, remarked the other day that all the electric lighting plants that are returning the best dividends to the stockholders are driven by Westinghouse engines. He could not tell what the reason was, because he did not like the Westinghouse engine, but he was certain that the companies using it generally made money.

Those who have paid any attention to heat problems must be familiar with the name of Professor Tyndall, the English scientist and author of "Heat a Mode of Motion," and of many other valuable scientific books. Professor Tyndall died last month, and in his death science has lost one of the most industrious toilers and lucid experimenters.

PERSONAL.

Mr. W. V. S. Thorne has been appointed superintendent of the Eastern Minnesota, succeeding Mr. F A. Merrill, resigned.

Mr. C. W. Nelson has been appointed superintendent of the La Porte, Houston & Northern, with headquarters at Houston

Mr. J. M Sheer has resigned as master of rolling stock of the Baltimore & Ohio Southwestern, and the office has been abolished.

Mr. E. B. Wall, assistant to the first vice-president of the Pennsylvania lines west of Pittsburgh, has gone to Europe on business connected with the company.

Mr. George W. Cushing, the well-known master mechanic, has accepted the position of master mechanic of the Queen & Crescent, with headquarters at Ludlow, Ky.

Mr M. E. Olmstead has been elected president of the Buffalo & Susquehanna road. Mr. F. H Goodyear taking the position of vice-president and chairman of the board.

Mr. M. V. Sullivan is now general manager and Mr. Frederick Settelle superintendent of the Jacksonville, Mayport & Pablo Railway & Navigation Company, with headquarters at Jacksonville, Fla.

Mr. W. J. Vance, for several years general foreman of the Cleveland, Akron & Columbus shops at Mt. Vernon, Ohio, has been appointed master mechanic of that road, with headquarters at Mt. Vernon.

Mr. C. M. Lawler has been appointed general manager of the Philadelphia, Reading & New England, with office at Hartford, Conn. He was, until quite recently, on the Reading as superintendent

Mr. George Royal, Jr., representing the Ajax Metal Company, Coolbaugh & Pomeroy, and the American Balance Lid Valve Company, has moved his office from the Rialto to No. 1007 Monadnock Building, Chicago.

Mr. Henry Schlacks, formerly superintendent of machinery of the Illinois Central, has accepted the position of superintendent of machinery and rolling stock of the Denver & Rio Grande, with headquarters at Denver, Col

Calvin Youmans, who for many years has been foreman in the Rome, Watertown & Ogdensburg shops, at Oswego, N Y., has resigned to accept a better place in the new shops of the N. Y. Central & Hudson River, at Depew.

Mr. Geo. K. Lowell has been made general superintendent of the Louisville, New Albany & Chicago He was previously assistant superintendent of the same road, and earned the promotion by the ability displayed in the lower position.

Mr. T. G Duncan, formerly superintendent of the car department of the Baltimore & Ohio Southwestern, has been appointed assistant master mechanic of the Ohio division of the consolidated road, with headquarters at Chillicothe, Ohio.

Mr George R. Cassie has been appointed master car painter of the Lake Shore & Michigan Southern, with headquarters at Cleveland, Ohio, and will have general oversight and direction of all the painting done at the different shops, reporting to the general master car builder

Mr. C. Skinner, who has been general foreman of the mechanical department of the Ohio & Mississippi at Washington, Ind., has been appointed assistant master [illegible] of the Mississippi [illegible] of the Baltimore & Ohio Southwestern, with headquarters at Washington, Ind

John De Lancey, who has pulled the limited express between Susquehanna and Hornellsville for the past twenty-five years, is the inventor of a variable exhaust nozzle that is in quite extensive use on the Erie road. Mr. De Lancey is the inventor of the balanced slide-valve that bears his name

Mr. A L. Mohler has resigned the position of general manager of the Great Northern. Mr. Mohler has been on the road for eleven years and developed decided ability as a general manager. There can be no strong men near Mr Hill's throne for any length of time, so there has been a change of government.

Mr I G Buchanan has accepted the position of general agent for the Union Car Mfg Co., of Depew, N. Y Mr. Buchanan has been remarkably successful in selling railroad supplies, and we feel assured that this new car company have done a good stroke of business in securing his services His office is in the Havemeyer Building, New York.

Mr J J Casey, superintendent of motive power of the Yazoo & Mississippi Valley has been appointed assistant superintendent of machinery of the Illinois Central with headquarters in Chicago. Mr Casey rose through the car department and is exceptionally posted in everything relating [illegible] He was for some years superintendent of the Missouri Car & Foundry [illegible] at St Louis

Mr H F Whitcomb, late general manager of the Milwaukee, Lake Shore & Western, and now general manager of the Wisconsin Central, was recently waited upon by the conductors of the first named road, and presented with a handsomely engrossed set of resolutions and an [illegible] cane with a solid gold handle, as a token of the high esteem in which he is held by the employés of the road

The day before Mr. John D. Campbell who has been assistant superintendent of motive power of the New York Central for the last three years, left the Depew shops he was presented with a very handsome set of desk furniture by his office men and a silver service subscribed for by the workmen The Depew shops were built, equipped and put in operation under Mr. Campbell's supervision. The work done is a good monument to the ability of the man who carried it out.

Mr. W. L. Boyle has been appointed master mechanic of the New York, Susquehanna & Western, with headquarters at Jersey City. Mr. Boyle was raised on the Erie and rose there to be foreman of the machine shops at Jersey City. He was general foreman of the New York Central shops at West Albany for several years, and had immediate charge of the construction of the famous "999." He has been teaching applied mechanics in an industrial school in New York since he left West Albany.

Mr. Isaac D. Barton, who has been general superintendent of the New York & New England since January, 1892, has resigned that position, and the duties of the office will be assumed temporarily by Vice-President Odell. Mr Barton was general superintendent of the Long Island railroad before going to the N Y & N. E. There is talk of his returning to the Long Island, the time for the periodical shaking up of the officers of that road having come round. Rumor says that Mr. Corbin has got tired of his highly ornamental general manager and intends to fall back upon utility again.

A Head-End [illegible] the Cylinder [illegible] Frame [illegible] in Center of Wreck

One of our correspondents, on the Rome, Watertown & Ogdensburg, writes "Of course we are all much interested in the promotion of Mr. G. H. Hazelton to be assistant superintendent of motive power of the New York Central. Mr. Hazelton has been master mechanic here for thirteen years, during which time several entire changes of management have taken place, none of which have affected him. His entire railroad experience has been gained on the R. W & O., having started in as water-boy on a work train. Then he learned the machinist trade in the shops at Rome, from which he rose, step by step, to be superintendent of motive power"

Mr. Amos S. Watts, master mechanic of the C. J. & M., at Marshall, Mich., had rather an exciting experience last month, one which every officer compelled to discipline transgressors is liable to to go through. An engineer named Calhoun had brought his engine in with the heater frozen, and Mr. Watts gave him a lecture about his neglect The man went home and told his wife that he had made his last run on the road. Then he went out and got crazy drunk, and imbibed enough coward courage to make him savage. Next he armed himself with a revolver and tried to shoot his wife She escaped, so the man proceeded to Mr Watts' residence and fired several shots at the master mechanic. As the shots did not reach their intended victim, the drunken animal grappled with Mr. Watts, and was in a fair way to commit murder when help arrived and the man was disarmed.

We have received from Topeka, Kan., a marked paper with an article relating to our genial friend Mr. James B. Brady. It seems that Jim took his diamonds with him when on a visit to Topeka, and his appearance took away the breath of the hotel clerk. Jim walked down to the office with his underclothes in his arms and asked to have them put in the safe. When he turned open a leg to show why the underclothes needed a place in the safe, the clerk declared that it gave him such a turn that any one might have knocked him over with a sledge-hammer. News of there being a man in the hotel with $40,000 worth of diamonds used as buttons went through the city like a Kansas sand-storm, and Jim was besieged with reporters and people anxious to examine the treasures. The event was the greatest sensation Topeka has seen since the dual Legislatures were struggling for supremacy.

Mr. Frank Hedley, who was appointed master mechanic of the Lake Street Elevated Railroad of Chicago, about a year ago, has acted as superintendent ever since he went to the road. Col. Alberger, the general manager, quickly perceived that Mr. Hedley was a man of many resources and a good executive officer, so the details of putting the road in working order were left to him. The successful work he performed has now received practical recognition in his appointment to be general superintendent of the road. We congratulate the management on the excellent appointment. Mr. Hedley rose in the Manhattan Elevated Railroad shops to be general foreman, and from there was appointed master mechanic of the Kings County Elevated Railroad of Brooklyn Most of our readers are aware that he is grand nephew of William Hedley, of England, who built the first locomotive that did practical railroad work.

Another man who began life on the lowest rung of the railroad ladder has just reached the top. Mr. C W. Case has been promoted from general superintendent of the Great Northern to be general manager of the same road. He began in 1851 as brakeman on the Chicago, Milwaukee & St. Paul and rose on that road through the steps of fireman, engineer, station agent, general freight and ticket agent to the position of superintendent. He went from there to be general superintendent of what is now called the Great Northern. Mr. Case did not rise by staying qualities, but by the native energy that will not rest in a subordinate position. He was not only ambitious to rise but was industrious in educating himself to be equal to the requirements of higher rank Like many other self-made men, Mr Case is a great admirer of his creator, but he is an exceptionally good railroad man and will succeed on the Great Northern until he excites the jealousy of the chief stockholder.

W G. Van Buskirk, division master mechanic of the Terre Haute & Indianapolis (Vandalia line) at Paris, Ill., died suddenly on board a train at Terre Haute, Ind., Nov. 29, death being due to the rupture of a blood vessel in the brain. He was born in Lansingburg, N. Y, Sept. 14, 1828, and in early life located in Chicago, where he was foreman of the Chicago & Fond du Lac shops. From Chicago he went to Kenosha, Wis., to accept a similar position with the Kenosha & Rockford Railway shops. During the war he was established in Winona, Minn., and had charge of the construction of the first railway west of the Mississippi. In 1865 he returned to Fishkill, N. Y., where for seventeen years he was master mechanic of the Newburg, Dutchess & Connecticut Railway shops. He then accepted a similar position with the Cleveland & Marietta Railroad at Cambridge, Ohio, remaining there five years, and went to the Terre Haute & Indianapolis as master mechanic at Paris, Ill., four years ago.

Mr. A. B. Underhill, long superintendent of motive power of the Boston & Albany, has resigned, owing to ill-health. Mr Underhill learned the machinist trade at the Amoskeag Works, in Manchester, N. H., where he mastered the art of locomotive building. For two years he was employed at the Manchester Locomotive Works, and then went to Boston, where he held a responsible position with the Hinckley Locomotive Works. In 1859, he was made superintendent of the Boston & Worcester railroad shops. In 1863, he went to Meadville, Pa., and was for a year master mechanic of the Atlantic & Great Western Railroad. In May, 1864, he returned to Boston as master mechanic of the Boston & Worcester. When that railroad became a part of the Boston & Albany, he continued in the position, until in 1880 the business grew so that the office of superintendent of motive power was established for him. He has since been in entire charge of locomotive building and repairing on the road.

The older generations of railroad men will remember Chauncey Hibbard, who was at one time general manager of the New York Central. Like many another railroad man who has been successful in early life misfortune came to Mr. Hibbard in his decline of life. Consolidations and change of proprietorship threw him out of a position at an age when re-employment was difficult. After vainly striving to obtain a railroad position, he accepted the selling agency for track scales. While following this business, he called one day upon Marvin Hughitt, then general manager of the C. & N., and asked if he could sell him a track scale. Mr. Hughitt was a railroad man of a later generation, and Mr. Hibbard supposed that he was talking to an entire stranger. After he had explained the merits of the scales, Mr. Hughitt said, "We will take ten sets of these scales." Mr. Hibbard was perfectly amazed, for he sometimes had weeks of labor to sell one set of the scales, and he had never before sold more than two in one order. On beginning to express his surprise and gratitude, Mr. Hughitt stopped him, and asked, "Did you never see me before?" The old gentleman looked searchingly but could not recall Mr. Hughitt's face. "Do you remember a telegraph messenger boy, who once came to your office and asked a pass to Buffalo because he wanted to go West, and was too poor to pay fare? Do you remember how readily you granted the favor?" The old man faintly remembered something about it. "Well," said Mr. Hughitt, "I was that boy. We need track scales, and it does me good to be able to order them through you."

Boiler Inspection.

The steam pressure carried on many locomotives is now so intense that the danger of explosions is greatly increased, a condition of affairs that has caused much nervousness among the men connected with locomotives. For the last year or two the silent fear has been made manifest by discussions about boiler inspection, and inquiries into how locomotive boilers can be kept in safe condition. This is a very wise and judicious line of investigation. It is one where increase of knowledge will be certain to promote increase of security. Locomotive designers and builders are so well-informed as to the strains which a boiler will withstand safely, that when it is new there may be no more apprehension concerning the safety of a boiler carrying 200 pounds of steam than there is with one carrying 140 pounds. Railroad men need not suppose that they can promote the interests of safety by sending inspectors to watch that high-pressure boilers under construction are properly braced or stayed. There is not the least ground for suspicion that the new boiler will not be strong enough. The season for justifiable misgiving is when the boiler has been twisting and moving for months under the variations of heat and pressure and the fastenings are beginning to fracture or become loose. Then is the time for efficient inspection to step in and make the boiler secure. If that is carried out properly a boiler can be maintained as safe as it was when it left the builder's hands.

Efficient inspection is, however, more spoken of than practiced. To render the inspection efficient, it must be done systematically and by skillful men. The leading source of danger is the stay-bolts. A portion of these have a short life, and only constant vigilance by men who are skillful enough to detect defects can prevent accidents. The weak thing about many of our railroads is that the boilers are not systematically inspected. The work may be done regularly at certain points, but at others the work is neglected, and an engine may happen to be sent to the place where loose methods prevail at the time when the boiler needs the closest vigilance. On other roads good systems of inspection are organized, but they are merely on paper. The real work is not done regularly. When business is light or normal the inspection will be done as arranged, but when an unusual demands exists for power inspection is omitted. This is inviting disaster.

Answer Circulars.

The chairman of several of the committees appointed by the Master Car Builders' and Master Mechanics' Associations to investigate subjects for report at next convention are making the old complaint that they cannot get members to answer circulars. The members expect that good reports will be submitted at the conventions, reports that will be creditable to the associations, but too many of them throw upon others not only the labor of compiling the reports but all the labor of finding out information. There are few members of either association who are not in a position to supply some facts bearing upon the subjects under discussion. Those who possess these facts and do not send them in are acting unfairly to the association and to themselves.

Many people are not aware that the act of collecting information on any subject is a good educational process. There is no man who has ever been a chairman of a committee and prepared a report, who has not learned a great deal about the subject investigated that he would never have known but for the work entailed. In a smaller degree, every man who collects information to answer circulars, increases his own stock of knowledge. We can, therefore, repeat the appeal for members to answer circulars, on the ground that they are going to receive benefit from the work they do.

The Traveling Engineers' Association committees are sending out their first circulars. We appeal to the members of this association not to fall into the habit of neglecting to answer circulars.

Do Your Duty.

The following circular has been sent out by Secretary Sinclair to the members of the Railway Master Mechanics' Association:

"Sweer is the mon wha winna gie advice," says a Scotch proverb, and the same philosophy adds, "e'en the diel will sha the wy tae Perth."

Members ought to be prompt answering circular questions of committees—it's as cheap and as easy as to "gie advice," or to point out the right road to a traveler.

Committees do lots of work for the benefit of the association. Lend a hand. It is a duty and ought to be a pleasure.

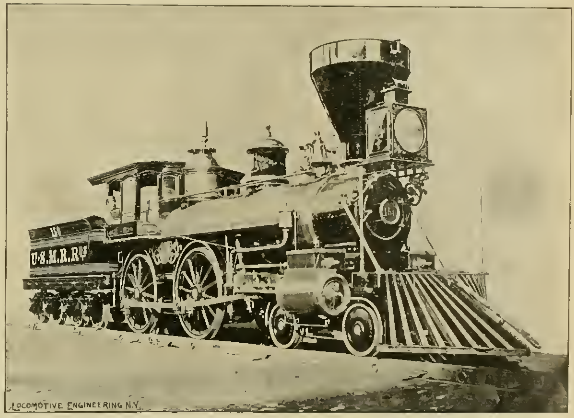
The Ajax Metal Co., of Philadelphia, Pa., are preparing for a very large business, which the well-known wearing quality of the "Ajax" metal warrant them to expect. They have added to their present plant a large machine shop and laboratory and will be in position in the near future to serve their friends. They will make finished castings made of Ajax metal, a specialty for all kinds of service, acid metal and fittings, etc., of every description. The laboratory will be under the control of a graduate of the University of Pennsylvania, whose authority cannot be disputed in an analytical way. This is done in order to accommodate their friends and patrons, and they propose making it a particular branch of their business. This company had already a large plant but it was found inadequate in good times, so that now they can promptly fill orders of any size with which they may be favored. —*Railway Review.*

If there are any railroad men in the neighborhood of Cleveland who are inclined to magnify the minor troubles of life, and to grow cankered care out of trifles, we would advise them to pay a visit to the household of George W. McGuire, of the Butler Drawbar Attachment Co. His numerous friends will be pained to learn that George is suffering from a dangerous malady, liable to prove fatal at any moment, yet of a nature that may spare his life for many years. Mrs. McGuire has been in delicate health for years, and lately has been confined to bed for a month. With these conditions to make gloom, there is no more cheerful household in Cleveland. The writer spent an evening there lately and was impressed beyond words with the courage of the husband, and the cheerful, enheartening spirit of the brave wife.

The Rodger Ballast Car Co., Monadnock Building, Chicago, have just issued a very handsome illustrated catalogue of their car, showing the methods of handling ballast when Rodger cars are employed. Every man interested in ballasting railroad tracks ought to study this catalogue. It would show many a railroad manager how he could, at small expense, change mud roads with all the resulting shortcomings to ballasted roadbeds capable of sustaining traffic without driving the ties out of sight. A railroad vice-president writing about these cars says, that two trains of them does the work of four trains of ordinary flat cars.

Mr. Henry L. Leach has resigned the position of master mechanic of Tunnel division of Fitchburg Railroad, with which he had been connected for thirteen years as draughtsman, general foreman and division master mechanic, and will devote his time entirely to the introduction of the excellent track sanding device of which he is the inventor. Judge Hammond has just decided that Mr. Leach is the rightful owner of these patents, and he proposes to push their introduction.

The New York Central people have decided to send the fast locomotive "999," which was exhibited at the World's Fair, to San Francisco for exhibition at the California Mid-Winter Exhibition. The intention is to have the engine pull the Wagner train which attracted so much attention at the World's Fair, as that train will also be sent to California as one of the attractions of the Mid-Winter Exhibition.



Rogers Locomotive, Built for Uncle Sam's Military Railroads During the War

The train of Krabel cars that was exhibited at Chicago was sent to the Chicago & Alton shops at Bloomington for some alterations, and the work has been finished. The train will be employed during the winter in excursion business between Chicago & California.

Mr. W. T. Small, superintendent of machinery of the Buffalo, Rochester & Pittsburg, has been in the hospital getting a painful surgical operation performed. We are pleased to learn that the operation was successful. He is recovering rapidly.

The Boston & Albany have just put two traveling engineers into service for the first time, they having gotten along all these years without them. Engineers Horton and J. W. Chamberlain being the men selected for the positions.

Baldwin's have received an order from the Norfolk & Western for nine consolidation compounds, cylinders 14 in. and 24x24 in., to weigh 135,800 lbs.

The Buffalo, Rochester & Pittsburg have just contracted for the building of eight locomotives and 200 cars.

Proverbial Philosophy in Railroad Management.

The late N. E. Chapman used to tell famous stories about the way things were managed on the Baltimore & Ohio when he was superintendent of motive power of that railroad. In the early years of railroad history the Baltimore & Ohio had been the most enterprising and progressive railroad in the country, but under the sway of the Garretts it fell into a fossil condition. Twenty years ago, the managers of the property conceived the idea that its machinery of all kinds and the methods of operating the same had reached perfection, and that no change could be made without spoiling something. The same sentiment crystallized was found ruling when Mr Chapman was appointed in [illegible].

Before taking hold, Mr Chapman was required to meet President Garrett, to receive instructions concerning the policy that must be pursued in his department. After dwelling at considerable length upon the glories of the B. & O., and the honor it was for an outsider to be admitted into that exclusive fold, the president said: "In the management of this great property I have found it wise to adhere to the principles concentrated in certain mottoes. You will find safety and assurance by adhering to them. They are: 1. Make haste slowly. 2. Never throw away anything that may be useful. 3. Make certain that you are right before you make a move. 4. Let well enough alone. If you guide your [illegible] by these principles you will make a success on the Baltimore & Ohio."

After Mr Chapman got into harness, he discovered that the proverbial philosophy, on which the road was managed, had numerous drawbacks. The mottoes were too inflexible for reaching the recurring difficulties of railroad service and important matters had often to go unsettled while some one was cudgeling his brains to find a proverb to fit the case. The thing came to resemble in a distant way the case of the king of France, whose foot got entangled in a stirrup, and who had to hang [illegible] with his feet in the air till the official authorized to touch the person of the king could be found.

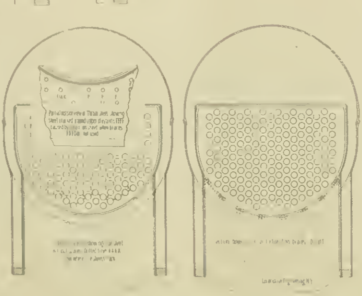
It [illegible] appears that Mr Chapman wanted to rebuild twenty-nine camel back engines by sending them through the company's foundries and furnaces. Nothing belonging to the B. & O. that might be useful had ever before been passed into the mouth of a fiery furnace, and it was a question how authority could be obtained to perform an operation that smacked of innovation. Mr Chapman sent in a formal notice to the president of what he intended to do, and waited three months for an answer, and none came. Then he sent the locomotives to be converted into new iron and steel. Eleven months afterwards he received a letter asking on what authority he sent the engines to be rebuilt in his thorough fashion. He turned up the corner of the letter and wrote thereon: "Silence gives consent." That settled the case. He had found a motto to suit it.

Reputed and Real Condition of Compounds.

Nearly everybody is aware that hundreds of appliances designed as improvements on railroad rolling-stock have been condemned by the prejudices that made them out to be worthless before they were tried. Under the withering breath of prejudice, meritorious devices have been often tried merely for the opportunity to give them emphatic condemnation. There is some danger that this oft-repeated process will be found at work in this year of grace and reputed enlightenment condemning compound locomotives. To condemn and to contemn compound locomotives is as much the fashion at present as the shoulder bustles on women's dresses. When builders or inventors find their compound locomotives discredited, it is a good plan to insist on getting figures of performance.

People in New England have been familiar for the last year or two with gossip about two Vauclain compounds on the New York & New England which were reputed to be the worst kind of failures. The subject came to be so much talked about that a representative of the Baldwin Locomotive Works went to Boston to investigate the matter. He found Mr Barton, superintendent of the road, emphatically opposed to compound locomotives for the following expressed reasons:

1. The company had no money to spend experimenting.
2. They wanted locomotives to earn money.
3. They wanted locomotives to pull cars.



4. They wanted locomotives that would keep going.
5. Compounds were in the shop too much.
6. Compounds cost too much money for repairs.
7. Compounds did not maintain their economy.
8. Would wait for compounds when they were perfected.

This was a very imposing array of charges against the use of compounds, and Mr Barton was exceedingly emphatic in giving them expression. When he was asked for figures to sustain his objections to the locomotives that had been in service for eighteen months, he had no data to give, but he was perfectly willing to provide every assistance in obtaining records of the engines. With this means of securing facts, the representative proceeded to investigate. He obtained the performance sheets of the road, and with the aid of the motive power clerk selected ten of the best simple engines as a basis of comparison for the compounds. Compared with these it was found that the compounds pulled 19 per cent. more cars, and did the work with 25 per cent. less fuel. During one month that the compounds were reported to have behaved very badly, the records showed that they had made the greatest mileage during their history, and their monthly mileage at all times exceeded that made by the hardest run simple engine. The records proved, moreover, that the compounds cost less for repairs per mile run than the simple engines. The saving of fuel alone was computed to be $1,680 a year, nearly enough to pay the wages of engineers and firemen.

The figures produced from the company's own records could not be confuted. The converse of the picture first presented of the compound locomotives was finally accepted as the true one. The company decided to order more compounds on the grounds that

They earn more money,
They pull more cars,
They do the work on less fuel, and
They cost less for repairs than simple engines.

A very exhaustive circular has been issued by Mr. A. E. Mitchell, chairman of the Master Mechanics' Association committee on tire treatment. He asks for information of a very comprehensive character in relation to tires, which includes facts about shrinkage and about methods of fastening the tires, how to measure wear, etc.

The mechanical department of the Long Island Railroad have been making some tests to ascertain the relative value of compound and simple locomotives. The work was done by the officials belonging to the road. They found that the compounds saved 17 per cent. of water and 37¼ per cent. of fuel as compared with good simple engines.

Plan for Preventing Distortion of Flue Sheet and Front Sheet of Firebox.

Master mechanics who have had trouble with springing of front sheet to firebox and the lower portion of flue sheet may pick up a valuable pointer in the sketches shown herewith, which illustrates the method employed to overcome this trouble by Master Mechanic D. Brown, of the D., L. & W. road.

Mr. Brown found they were having trouble in the place indicated. There was a tendency for the flue sheet and front sheet of water leg to bulge in, as shown in dotted lines in upper left-hand cut, producing cracks between flue holes as shown, and the outside of throat-sheet showed evidence of being pulled in, there being considerable cracking around the stay-bolts.

It was concluded that the long flat surface between the top row of stay-bolts, in the front of the box, and the lower row of tubes, that is practically without stays—was the cause of the trouble.

In some new fireboxes this trouble was cured in a very simple manner, as shown in the right upper sketch.

The flange of the front firebox sheet was turned some three inches longer than necessary for the seam, and extended back into the water space. This was drilled with a row of holes, and fork end braces were carried from it well ahead to the second and third course sheets of the barrel of the boiler. This stays the weak spot very nicely, and makes a neat, workmanlike job, and is not liable to collect scale and mud at a dangerous place as are short, rigid braces tapped and riveted into the firebox sheet and fastened to the first course ahead. This plan seems to have many things to recommend it and nothing to condemn it.

The round jaw nonpareil ratchet made by the Keystone Manufacturing Co., Buffalo, is making steady progress into favor in railroad shops. As soon as one is tried in a shop it quickly causes other orders to be made, for the men using it call it the handiest tool for running repairs that they had ever tried. There are so many places in doing locomotive and car repairs, where an ordinary wrench cannot be turned that much time is wasted, and much profanity inspired. In such places the round jawed ratchet takes hold and the nut can be worked off from almost any position. We have heard the tool talked of so highly by the men using it, that we cordially advise railroad men to try it.

A new folder has been gotten up by George H. Daniels, general passenger agent of the New York Central, and is called, "An Object Lesson in Transportation." It describes the Wagner train exhibited at the World's Fair, and also the train exhibited by the London & Northwestern. In addition to that there are descriptions and illustrations of the "999," the compound locomotive "Queen Empress," and the "De Witt Clinton" with its train. Persons anxious to have a souvenir describing this interesting and historical railroad rolling stock will find the new folder a good thing to keep.

The repair shops of the Baltimore & Ohio, at Mount Clare, Baltimore, are reported to be working full time with the entire force of men. When the depression came, these shops were put on short time working five days a week. Business on the road did not diminish a great deal, and bad order cars and worn-out locomotives have accumulated more rapidly than they could be cared for. A full force of men is now wrestling with the work, when the days are short and the gas-light long. This is the way to provide employment for idle hands.

A patent has been granted to Mr James McGee, Houston, Tex., on the car brake apparatus which dispenses with the use of brake beams, and which we illustrated some months ago.

Practical Letters from Practical Men.

Facts Wanted. There's a glut of Opinions.

Write on one side of the paper, state your point plainly and briefly, and then quit. We supply the generalities. No letters noticed unless name and address accompany.

Why Those Men on the Exploded Locomotive Might Not Have Heard any Report.

Editors:

In your November issue you give particulars of a boiler explosion on the Seaboard Air Line, which took place on the 27th of July last. Three men riding on the locomotive at the time of the explosion say that they did not hear any report, although the first barrel sheet of the boiler was entirely blown away. Permit me to offer the following explanation of the phenomenon:

The accident happened in the latter part part of July. In computing the velocity of sound, a probable atmospheric temperature of, say 80° F. should be allowed. The velocity of sound in air at this temperature is 1,150 feet per second. (See "Trautwine's Civil Engineer's Pocket-Book," 1881. The initial velocity of escaping steam at 150 pounds pressure is 2,004 feet per second (See Bourne's "Hand-Book of the Steam Engine," 1873). The pressure in the boiler at the time of the explosion, it is said, was 1?? pounds. It is therefore probable that the initial velocity of the steam escaping from the exploding boiler would be in the neighborhood of 2,000 feet per second. This velocity would be, with small loss, imparted to the flying pieces of debris, as the boiler was torn apart.

By comparing these facts it will be apparent that if it were possible to maintain these velocities unaltered for one second, then a broken rivet or piece of boiler plate would travel 850 feet further than the sound of the explosion in the same time, although both began to move simultaneously.

In reality, however, the velocity of sound does not diminish, though its intensity may do so. The speed of the irregular pieces of metal and debris, though thrown with a higher initial velocity, would steadily lose their velocity in the air until brought to rest on the ground after a comparatively short flight.

The three men in the cab of the engine who did not hear any report may reasonably be supposed to have been sitting about ten feet from the center of the explosion. At that short distance, the decrease of velocity of steam and debris, due to the resistance of the air, may practically be disregarded. With initial velocity of 2,000 feet per second, the rush of steam and broken metal, etc., must have struck these men in the one two-hundredth ($\frac{1}{200}$) part of a second after the explosion, and instantly overpowered them. The sound of the explosion, starting out at the same moment with velocity of 1,150 feet per second, would reach the men—provided they were not blown further away—in the one hundred and fifteenth ($\frac{1}{115}$) part of a second. Strange as it may seem, therefore, the seventeen forty-six hundredth ($\frac{17}{4600}$) part of a second (very close to being $\frac{1}{270}$ part of a second) actually elapsed from the time the rush of steam and debris struck the men and stunned them until the impulse of sound passed over them and filled their unconscious ears.

GEO. S. HODGINS.

Windsor, Ont., Can.

What Pressure Shall We Carry With the New Brake-Valve?

Editors:

A question often asked, especially by roundhouse repairmen, and one that is now being vigorously discussed on this road is, "What must the pressure be on the main reservoir when using the Plate D 5 brake-valve on passenger train." and I very much wish an opinion on this subject by those who have had some experience in this matter. My position is that there must be such an amount in main reservoir, that it will fill an empty train-pipe to a higher pressure than can be obtained in the brake-cylinders and auxiliary-reservoirs by an emergency application, and as with a 12 x 33-in. reservoir and 10-in. brake-cylinder with 8-in piston travel 60 pounds can be obtained, and some pistons often travel 6 in. with an increase of 2 pounds to the inch, so that it would not be safe to figure the amount in auxiliary at less than 64 pounds, while the friction on the slide-valve would be at least 1 pound more. It would then be doubtful if in case of an emergency application, some brakes would come off till the pump brought the pressure up to 65 pounds, unless there was sufficient capacity in either volume or pressure, in main reservoir, to promptly supply such an amount to train-pipe. Suppose a red light should be met on a bad grade just coming around a curve, the train-pipe would be exhausted, and if the flag was picked up immediately, the brake-valve handle would be thrown to release position for an instant and train started as is often the case down hill, and some of the brakes could (and if the train were long enough probably would) stick on until air enough had been accumulated to release them. Meanwhile the cars that had been started with the brakes set would be likely to slide their wheels, and on ordinary grades cause loss of time in starting the train.

In looking up this matter, I measured several engines, getting on an average 60 feet of 1-in. pipe that was exhausted by an emergency application, and after measuring a number of coaches and Pullmans, found over 69 ft. of pipe to a car, not counting the crossover pipe, cavities in train-pipe strainer, triple-valve, pipe to conductor's valve or hose couplings, which would average 100 cubic inches more. Now, a 12 x 33-in. reservoir expanding into a 10-in. brake cylinder at 8-in. piston travel, equalizes at $\frac{6}{7}$ auxiliary reservoir pressure, which is 70 pounds, as there is a $2\frac{1}{2}$-in. depression at either end of this reservoir. It would not be safe to call it over 28 in., which makes $12\times12=144\times.7854$, giving 113.09 square inches $\times 28 =$ 3,166 cubic inches, while the brake cylinder gives $10\times10=100\times.7854-78.54$ square inches $\times$ by 8-in. piston travel = 628 cubic inches; then if 628 cubic inches, added to 3,166 cubic inches, will reduce 70 pounds pressure two-sevenths, any reservoir will reduce two-sevenths at any reasonable pressure if its volume be added to in the same proportion as the brake cylinder stands to the auxiliary, which, for easy figuring, we will say is as one to five, and allow the 26 cubic inches over in the reservoir for thickness of sides and ends. The main reservoir on engines was $26\frac{1}{2}$ x 34 in., which the Westinghouse catalogue, page 31, tells us contains 16,500 cubic inches. If the pressure be 90 pounds, a reduction of two-sevenths would give 64.30 pounds, and 3,300 cubic inches, or one-fifth in proportion, added to main reservoir volume, would be sufficient to accomplish this reduction, the train-pipe on engine and tender would furnish 60×12 in. = 720 in. $\times$ .7854 = 565.4880 cubic inches, and for each car 100 cubic inches is added, so that four coaches and engine would only lack 75 in. of the required amount, and consequently if no brake cylinder pistons traveled less than 6 in., would just release, and with five or more coaches would be apt to drag till the brakes pumped off. Of course, in this case the main reservoir must be considered too small with 90 pounds pressure, but no doubt there are a great many such in service.

In the supplement entitled, "Description of Improved Air-Brake Apparatus, 1892," on pages 10, 15 and 19, from 15 to 20 pounds excess is said to be usually sufficient, but I believe that in many cases where the brakes drag where the new valve is used, it will be found that the main reservoir has not volume enough at that pressure to insure prompt release unless time can be given to allow the pump to assist also. Might not this be where the trouble lies with our friends with the Plate D 8 pattern of valve. As for a rotary valve making itself a seat in running position, I should think that a valve in that condition would not be reliable on lap.

OTHER QUESTIONS.

Mr. Relyea takes the right stand as to purchasing instead of making parts for repairs; and as for the reducing-valve, Fig. 5, Plate D 28, the diaphragm-nut, No. 8, could not have been screwed down on diaphragm, Plate No. 6, and therefore not giving lift enough to supply valve No. 5. Brother De Sanno hits the nail on the head as to the lagging on air-pumps. Why case them at all?

If our East Albany friend will apply his brake, put his brake-valve handle on lap, and then watch the black hand a minute, he can tell whether his main reservoir pressure leaks through to his train pipe or not, as this hand will raise if the train pipe pressure be increased. It is well, also, to remember that the lower gasket, Plate D 5, will do this, and the rotary valve be in good order.

Roanoke, Va. GEORGE HOLMES.

How to Tell if All Your Air is Coupled Up.

Editors:

Engineers are depended on to make the stops, and a failure often results in an accident, because when they find the air is not working it is too late to bring the train to a stop by the hand-brake. A great many accidents have occurred when the train-line has been cut, and when reductions were made brakes would not work. I would like to call your readers' attention to an article written some time ago by Paul Synnestvedt, which, if practiced, will enable the runner to tell how many cars of air he has in train before he applies the brake to stop. He says, in order to tell how many cars are working, pump up train-line pressure to 70 pounds, with brake-valve handle in running position, and 20 or 25 pounds excess on main reservoir pressure.

Now move brake-valve handle from running position to full release and watch the red hand fall back; it will usually drop back one pound for every car of air working in the train, that is, if there are 5 cars it will drop back 5 pounds; 10 cars 10 pounds, and so on, of course, you cannot tell just to the car, but you can tell close enough to know if you have been cut out or have enough air to handle your train. There are a great many of the men practice it here, and can tell within a car or two of how many they have, and it is a very easy matter for engineer approaching a stopping place to move the handle to full release. If he finds air has been cut he will have time enough to get his train under control by the old Armstrongs before it is too late. It comes easy with very little practice, same as draping the lever in corner when shut off, and may save engineers from doing time for an air-brake failure.

W. G. WALLACE.

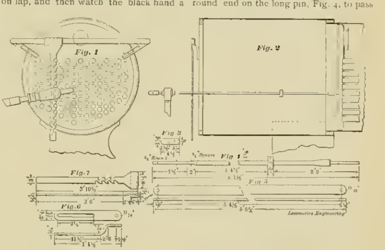
Rolling Flues by Power.

Editors:

I send you herewith the drawing of a flue-rolling machine I had made here, it is all blacksmith work, with the exception of the pin for rollers and the pin with the square end to go into the attachment with the flexible shaft, which we use for power.

Fig. 1 is a front elevation of a $56\frac{1}{2}$-inch arch, and Fig. 2 is a longitudinal section through the smoke arch and front flue sheet, showing the machine ready for work.

We get our power from a flexible shaft through a compound box, an attachment to a shaft for tapping and reaming. The square hole in the spindle of our box to hold the tap or reamer is $\frac{3}{4}$ in., so we drilled a round hole the same size, $\frac{3}{4}$ in., clear through the spindle to allow the long, round end on the long pin, Fig. 4, to pass



through and let the square part of the pin enter the square in the spindle, to allow it to turn the pin and the rollers. The collar, $1\frac{1}{2}$ x 3 in., is formed on the pin, Fig. 4, for the man in the smoke-arch to knock the pin out when the flue is rolled enough.

Fig. 3 is a cap to put on the long end of pin, Fig. 4, for the operator to hammer against to drive the pin into the rollers as the pin and rollers revolve. This saves the round end of pin from battering. A small set-screw is put in the cap flush on the outside and projecting about $\frac{1}{8}$ inch inside, running in a groove in the pin to prevent the cap and box from falling off.

Fig. 5 has two clamps, Fig. 6, riveted on to it for attaching it to the smoke-arch for a slide, the slots in Fig. 6 allow the slide to be moved in any direction to get it level.

Fig. 7 slides on the slide Fig. 5, and holds the long pin Fig. 4 level, steady and in line with the flues. The notches being cut down the sides to correspond with the flue centers (in this case the flues are $2\frac{1}{4}$ in. diameter and 3 in. centers) one side to the high row and the other side to the lower row, the operator changing the pin into the different notches to correspond with the flue he wishes to roll. In changing from a high to a low row or the opposite, the operator pushes the long pin into any convenient flue far enough to clear Fig. 7, then draws it out again on the other side as needed.

This machine rolls the flues heavy or light just as wanted, the operator after rolling a few knows just when to stop to get the required results.

CHAS. E. FOURNESS.

Dubuque, Iowa.

Some Brake Questions.

Editors:

Here is a pump which pumps up to 70 or 90 pounds (governor set at 70 and 90), then red hand falls back to black one and both fall back a few pounds, and pump goes to work again. Where is the trouble?

Engine coupled on to train; pump pumps up to 70 and 90 pounds; turn angle-cock off behind tank and will only pump 60 and 80 pounds. Where is the trouble? It is too hard for me.

Suppose on a train of fifteen cars there was quick-acting triple valves on the first five; on second five old style triples; and on last five quick-acting. Can an emergency action be got out of rear five, if brake is applied from head end of train?

WALTER M. PIRKIS.

Brainerd, Tenn.

Relyea's Reducing-Valve Puzzle.

Editors:

I should say that the trouble with Mr. Relyea's reducing-valve, referred to in December number of LOCOMOTIVE ENGINEERING, was in the diaphragm nut No. 8 having the grooves filled up with dirt, or perhaps a new nut was put on without grooves in it, which would fit up close to reducing-valve body No. 2, making a close joint and preventing the air from getting through to the diaphragm No. 7 as fast as it should. Another thing might cause the kind of trouble spoken of would be a short threaded end on the plate No. 6 allowing the supply-valve No. 5 to remain on its seat or nearly so, while the nut would strike the body No. 2. As this was the same reducing-valve that had been in use before, and given satisfaction, I am unable to give any other reason why it would not work properly, barring gum or dirt.

F. B. ARMSTRONG.

Cameron, N. Y.

THE ANSWER.

Editors:

Nut 8 has a shoulder which passes through the diaphragm and screws down on diaphragm plate 6. The diaphragm being rubber, and about $\frac{1}{16}$ in. thick, has a hole in the center to fit on the shoulder on nut; this shoulder, being only about $\frac{1}{32}$ in., holds the diaphragm firmly to plate 6. Diaphragm stem 6 touches valve 5 and presses it down until nut 8 (which is slotted) strikes body 2, allowing air to pass to train signal-pipe. So you see that stem 6 must go through nut 8 far enough to touch valve 5 and open it before nut 8 touches body 2. Now, whoever put the new diaphragm in this valve didn't cut the hole large enough to let the shoulder of nut through, consequently the nut was screwed down on the diaphragm, which prevented the stem 6 coming through the nut far enough to touch valve 5 before nut touched body 2, or at least it merely broke the point of valve 5 just enough to allow air to leak through very slow.

Syracuse, N. Y. W. F. RELYEA.

Can an Engineer Get Lost on His Engine?

Editors:

They say a man is never too old to learn, and I am after information. I have run a locomotive for twenty-two years, and in a recent conversation with one of our officers I made the remark that I had been lost in a snow-storm and also in a fog on the road, when I could not possibly tell where I was until my engine struck a switch-rail, and could then tell by the click of the switch-rail or the frog when I crossed it. He said it would never do to tell a jury, that nowadays they would not listen to me or exonerate me from blame on a statement of that kind if I had an accident between switches. He said I should keep a log—that is the remark he made—or, to explain, I should keep track of my mileage by the click of the rails on the road between stations, as engineers did not have anything else to do practically nowadays. Just turn on injector, etc., etc., let her go, and all the new improvements would do the rest, and then keep your eye on the gun and listen for the click.

Well, I looked pleasant and told him I had never heard of anything of that kind before, and he said, "Well, you have heard it now, and I told you." I said, "Well, I will venture $10 there is not a man in the country can tell exactly how far he has run in that way," he said, "Indeed there is; I will bet there is ten thousand." Another party standing by and looking very wise said, "Oh, yes, that is the way they run in the big fogs around London and New York City." Well, the next trip out I made an attempt to keep a log (in my head) and, well, say, I could not keep up with the clicks when I got under motion, there was about five inches of snow over the rail, and pretty soon there was no click, only a roar. Now, what I want to find out is this: can you produce a man down in that Eastern country, or one that is quite English, you know (Ah!), that can tell where they are by that click that gets away from me.

Possibly I am a little slow in catching them, or possibly I run too fast to keep them; but I am still willing to learn and want to keep up with the times; however, I do not claim but what a man can estimate pretty close to where he is, judging by the speed he is running and length of time consumed since leaving preceding station, but I want to hear from the man that can tell exactly, in a fog so thick you can cut off hunks any size you want, or a snow storm that banks front window, from running-board to roof, and will cut your face open when you stick your head out. Oh! by the way; do they steer ships by the log or by the compass? I am a little green about water craft or the navigation of them.

Green Bay, Wis. H. HANDY.

What a Patent is Worth.

Editors:

My attention has been called to an article headed "What is a Patent Good For?" in your excellent journal for November, 1893.

Patent law is so different from railroading that both your correspondent and the Editor seem to be in the dilemma of the wagon-maker's apprentice who got into Sunday school. He knew all about the spokes in a wagon-wheel, but did not know the number of Commandments in the Decalogue.

Many of your numerous readers are observing and practical men, liable at any time to make valuable inventions, and it is desirable that they should understand how to best secure the reward of their ingenuity.

It is true our patent system is not perfect, the words of the grant in a patent for instance, are not as clear as they should be and are easily misunderstood. "*The exclusive right to make, use, and vend the said invention,*" should be, "*The right to exclude all others from making, using and vending said invention,*" as that is all that a patent really grants any one. The right to make, sell, and use everything, new or old, exists in every body until cut off by a patent to some one, and the patent to any one person does not enlarge, or even define his limits, it simply gives him the power to limit some one else. "*Said invention*" refers to the description contained in the specification and claims. And here mistakes often arise. The claims are the "metes and bounds" of the invention, and much more than these cover is often necessary to be shown to make the invention understood. It is the same as with a real estate deed, which names the section, town, county, and State, to describe the land granted, while perhaps only forty acres, or even less, is conveyed. *Not the whole State.* So with patents, only what is claimed is considered, not all that is shown, or described.

In soliciting a patent all that is to be settled is: What did the applicant invent? What did he add that is new?

Whether this device, as a whole, shows an infringement is not inquired into, that is a separate matter, that any patent attorney will report upon, but it will not be determined by the process of soliciting. This inquiry should be made—and usually is by good business men—before manufacturing begins. Mr. Michael's friend A could have found all about that eight year old patent that made him trouble easy enough, but it was extra work, outside he case, not asked for or paid for by A. when he got his patent.

These matters are noticed and explained in nearly all patent attorney's circulars, and if A. chose to proceed without taking proper advice, he alone is to blame and not the "ignorance or cupidity" of attorneys, nor the system of the patent law.

If A. was sued for infringement, his patent was not considered, and could not be; it was the plaintiff's *patent*, and the *device* made by A., which device, to infringe, must have contained what was claimed in the plaintiff's patent. And it would be an infringement exactly the same, whether A. had a patent or not. Only when A. sues some one for infringing his own patent, could he lose it or have it construed by a court, or even considered at all.

The process by which men invent is according to natural law, and the statute law must conform to it. We must deal with the nature, qualities and functions of things, and the working of the minds of men as we find them.

Let us examine this briefly. Usually inventions grow from simple to complex, like a tree, first the trunk, then the branches.

All inventors seek to *do* something, for instance, to stop a moving train.

Some natural law is always active—friction in this case. A mechanism is organized to utilize this natural law; this is the invention, the patentable thing.

Generally the simplest structure, the fewest and necessary parts are first combined. These, in this case are the wheel, the shoe to slide on the wheel, and the lever to press the shoe against the wheel. Suppose this invention to be patented to A., the claim would be the combination of wheel, shoe and lever. This is a generic patent, the first of the kind, and the trunk of the tree, which, with its many branches is the complicated air-brake system now in use, the contribution of many separate inventions. Now B. adds to this inventon of A., the hand wheel, windlass and compound levers, thus inventing the hand-brake. A patent to B. would claim—in combination with wheel, shoe and lever—the old combination of A.—the compound lever, windless and hand wheel—the new of B.—a "combination on a combination" it is said, as though the attorney could avoid it. It is in the nature of things. What can the law do about it? or for these inventors? evidently only what it does do. B. must not use what A. invented. If he could, then a mere improver could take for nothing the work of others. Nor can A. take what B. adds; otherwise no improvements could be held by the inventor. Each have claimed only what they have invented. But it may be said B. is helpless, he cannot make an operative device without A.'s patented wheel, shoe and lever. If a man buys land having no road to it, he cannot therefore trespass, he had due notice of that fact, and must pay for a right of way. If a man cannot use his invention without infringing, he is in the same situation, he must invent around the obstacle, wait till the older patent expires; or procure a license from A. The mistake in such a case is in supposing that by issuing a patent to B. on a combination of his new elements with the new elements of A., that therefore he is assured of non-infringement. This is not true; an infringing combination may be patentable, and often is patented.

Many infringing patents are annually issued, and the question of infringement is never considered by the Government or attorney in soliciting a patent, and no decision by any Government officer can be had on that question under the rules of the Patent Office; it must always be by a court. Novelty, utility and invention are the only tests in the Patent Office. The larger combination of B. stands these, although it contains and infringes the smaller combination of A.'s patent. And B.'s rights, in spite of the words of the patent to him, are limited by A.'s patent. Now, C. provided the air-pump, reservoir, pipes, cocks, cylinder and piston, and we have the straight air-brake. He goes round B. and infringes on A., we have now the wheel, shoe and lever of A., plus the air apparatus of C. operated by steam, in place of the hand-operated apparatus of B. Then comes the vacuum-brake, another system invented by D., using steam, but avoiding the pump, reservoir, etc., of C., and we now have three separate branches, each embodying the combination patented to A., all using his wheel, shoe and lever. Each are independent of the other, and are three different and specific means of applying power to A.'s combination, and each infringing his patent. Now E. provides the auxiliary reservoir, triple-valve, etc., and appropriates the combinations of C. and A., leaving out B. and D., here are three combinations in series, A., C. and D., C. infringes A., and D. infringes both A. and C. So we might go on until the entire alphabet would not furnish inventions enough to illustrate the development of the brake systems in use. Driver-brakes, air-pumps, cocks, valves, couplings, auxiliary reservoirs, triple-valves, emergency or quick triple-valves, etc., are found on one branch only.

There is a tangle of interests, of course, but it is because of the nature of the inventive process, and unavoidable. No law of man made it so; no Congress can change the natural relation of these many inventions or their relative equities. Therefore, experienced men must be consulted who can and will advise accurately and safely where each inventor stands. Every year trains become more complicated, and more machinery and apparatus must be cared for and operated. Suppose a train in charge of inexperienced men should land in the ditch, because of neglect of some precaution familiar to an experienced crew. Who would you blame—the system of railroads or the management? That was the trouble with Mr. Michael's friend, A. He did not seek the advice that be needed.

The British plan of granting all applications as filed, puts the work of distinguishing the new from the old solely on the attorney, who, in this country, is held in check by examination, and refusal to allow bad or excessive claims. This would not help the trouble complained of by Mr. Michael, for the reason that no patent issued by any government on earth undertakes to determine or define the limits of the patentee; the limitations of his right to make, sell and use, must be found by examining the patents to others in force against him, his own patent means absolutely nothing in the inquiry, it shows only what he can stop others from doing.

LUTHER V. MOULTON,
Patent Attorney.

Grand Rapids, Mich.

[We are under obligations to Mr. Moulton and to Mr. Whittlesy for the very clear statements made—we were the boy who didn't know the Commandments—but we have called out a clearer statement of the case than could otherwise have been secured, and are therefore glad that we did not know better—our readers profit by it.]

The New York, Ontario & Western have ordered 500 cars from the Peninsular Car Works.

Cory's Force Feed Lubricator.

At the present time of very fast trains, making long runs between stops, the question of facilities for thorough and positive lubrication of all journals, eccentrics and links of the fast-moving engine becomes very important. The introduction of the device herewith illustrated and described marks a distinct advancement in securing the highly desirable means of oiling all important bearings of the locomotive, while it is running at full speed, and this is fully accomplished direct from the cab, from where it is possible to oil each bearing successively, or any particular bearing repeatedly, that may be giving temporary trouble by heating.

The lubricator is placed convenient of access in the cab, and consists of an oil supply reservoir of one gallon capacity; at the lower part of this reservoir is seated a hollow conical valve *A*, the cavity in this conical valve will hold about $\frac{1}{8}$ of a gallon. This space inside of conical valve is termed the oil discharge reservoir, and connects to oil supply reservoir by small valve *B*, seated in upper part of hollow valve.

The side of hollow valve is perforated by a hole *E*, ¼ inch in diameter, that can be brought to coincide with any one of the sixteen outlet holes at base of oil supply reservoir, that each connects with a line of pipe to a given bearing.

There are sixteen notches on the upper rim of lubricator, so that when lever is brought to engage with any one of these notches, the hole in the side of conical valve then coincides with a given hole in base to outlet pipe.

When the lever is thus placed for any bearing desired to supply with oil, the valve shown attached to base and connected to either steam or air pressure, is opened and pressure enters through small valve *C* into oil discharge reservoir, closing valves *B* and *D* and forcing contents of oil discharge reservoir through hole *E*, and through line of pipe connecting with bearing that is desired to oil.

This requires but a moment, when pressure should be shut off and lever placed midway between any two notches, and in about five seconds the discharge reservoir will again be filled and ready for discharging to any desired bearing, when lever is placed in notch corresponding to bearing to be oiled and pressure again turned on.

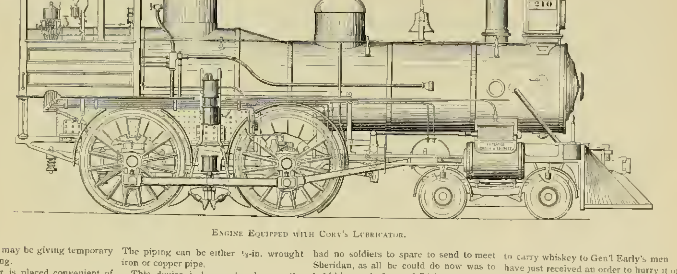
For all main journals three way tips are furnished for ends of pipe, thus the wedges and jaws are oiled as well as the journals.

The engineer has thus at his command a positive means of oiling all parts of his engine, however fast the engine may be running and however long distances he is obliged to run without stops, preventing any dangerous and destructive beating and cutting of bearings, delays of trains and possible accidents that might occur.

The use of this device is not intended to release the engineer from the responsibility of adjusting his present oil cups and inspecting and oiling by hand when first taking engine out from terminal station, the same as if engine was not equipped with the force-feed lubricator. There is simply placed at the disposal of the engineer a gallon of oil, that can be forced from the cab to any desired bearing as occasion requires.

There are now a number of locomotives running equipped with these lubricators, some having been in service for two years, and have never failed to perfectly perform their work, and none have required repairs of any kind to lubricator or any piping. The piping can be either ⅛-in. wrought iron or copper pipe.

This device is being placed upon the market by M. C. Hammett, Troy, N Y



ENGINE EQUIPPED WITH CORY'S LUBRICATOR.

Last summer, when we described the building of the new machine shop of the Pittsburgh Locomotive Works over the old one, we mentioned the fact that Superintendent Wightman had painted a few machine tools white—just as an experiment. Mr. Wightman has since painted all the tools in the works white; everything, even to the foundry, blacksmith) shop and boiler shop, has white tools. He says the advantages are so many and the disadvantages so few that eventually machine tools will always be painted this color. A streak of oil or other dirt is so painfully evident that the man in charge of a tool will not allow it to become dirty. The advantages of light are also of great value

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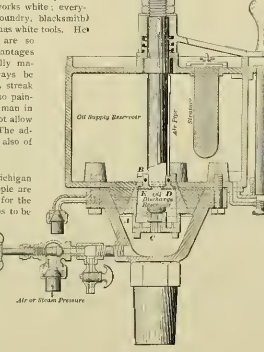
The Lake Shore & Michigan Southern Railway people are getting out drawings for the erection of large shops to be used principally for the repair of freight cars. President Newall has made up his mind that repairing cars on unprotected tracks does not pay The men are not able to do a fair day's work in cold weather, and stormy weather frequently stops work at times when the use of the cars is highly important to the company. We understand that the intention is to provide the new shops with the best facilities that can be found for doing the work expeditiously.

A circular has been issued by Mr. J. Davis Barnett, chairman of the Master Mechanics' committee on oiling devices for locomotives, calling for information on the subject.

Train Running for the Confederacy.

BY CARTER S. ANDERSON.

It was March, 1865. General Sheridan had beat General Early back up the Shenandoah Valley, near Waynesboro. It was evident—and a very serious consideration it was—that if General Sheridan was allowed to pass Rock Fish Gap and cross over the Blue Ridge into the eastern portion of Virginia, that it would seriously affect General Lee's rear and his main source of supplies for his army at Richmond, where he was still waiting and watching the crouching lion, Grant. Lee had no soldiers to spare to send to meet Sheridan, as all he could do now was to hold his own in front of Richmond. General Early, therefore, prepared to give battle at Waynesboro, and thus attempt to prevent the passage of Rock Fish Gap, one of the very few passages through the Blue Ridge. General Early very prudently held his supplies at Greenwood Depot, a station on the eastern slope of the Blue Ridge and just east of the last of four tunnels which lie between that point and Waynesboro.



CORY'S LUBRICATOR, SECTIONAL VIEW

Waynesboro is at the western base and Greenwood at the eastern. Two of our trains were held at Greenwood partly loaded, while a good many supplies were in the depot ready to be moved over to General Early if he so ordered, or to be sent flying down the grade to Mechum's River if the god of battle so decided. One day while there, shifting, unloading and reloading commissaries, Capt. A D. Wren (the father of our present C. & O. passenger conductor, W. D. Wren), who was in charge of the commissaries at Greenwood, acting under Maj. H M. Bell, G. M., came running over to the depot in great haste. The depot stands on a spur track about a hundred yards across from the main track. "Finks," said Capt. Wren to Conductor J. B. Finks, who had charge of one of the trains, "I want you to take your engine and run over to Waynesboro to carry whiskey to Gen'l Early's men I have just received an order to hurry it on as a fight is expected very soon. Just roll a barrel on the tender, back over to Waynesboro, put it out on the platform, and come right back. Don't get cut off there on the other side of these mountains and bridges."

"Good sir," said Finks, whose family lived at Waynesboro, "I want to get a clean shirt any way and tell the old lady good-bye."

Mr. R. W. Goodwin, his engineer, was informed, and soon got ready to load on a barrel of the liquid fire. It was corded up with the wood in the tender of the "Albemarle" (C. & O. No. 17), a Rogers engine, built at Paterson, N J., about 1855. It was a very fine engine, if it got good foothold, but would slip unless you gave her plenty of sand. The boys used to say that if you were to spit on the track old "Albemarle" would never go over it. As the engineer, Mr. R W. Goodwin, will be the most prominent character in my narrative, allow me to say that this Christian gentleman still lives and earns his daily bread by pulling the throttle. He now runs the C. & O., No. 123, ten wheels connected. As an almost daily witness of this man's conduct for thirty years, I can truthfully say that his life disproves the oft-repeated assertion that a railroad man cannot be a Christian. His religion is recognized by us all, and no one would dare ask him to deny his Master.

Backward sneaked the old Roger through four tunnels and over Smith River Bridge. When it came up to the platform at Waynesboro, Mr. James Wallace, the agent, took charge of the barrel "Bob," then said Conductor Finks, "I'll run home, and tell the old lady good-bye, and be back in ten minutes."

"All right," answered Mr. Goodwin, "but I am afraid Mrs. Finks will not let you return, as times are so squally around here. If you are not back in twelve minutes I shall leave you." "Just look here," suddenly exclaimed Agent Wallace, who was standing close to the "Albemarle." "Finks, our men are defeated! Look up the road! Look how they fly!" No one can give a description of the sight of cavalry scout fighting that will do it justice. To see a road full of fleeing cavalrymen, then their enemies hotly pursuing, is something one cannot forget, but which cannot be described. It must be seen to be appreciated, and you had better be in the bushes, as I was, when you go see it. The best time made on this turf is not on record, it lies buried in the grave of the "Great Unknown"

But the fleeing cavalry made it. Conductor Finks saw a plenty, and hesitating a moment over the ponderous question which presented itself to his anxious mind, "Shall I desert my train and share the fate of my family, or leaving them to the tender mercies of the enemy, shall I save my train and commissaries?" Finally with one foot on the platform steps of the "Albemarle, he said to Mr Wallace, "James, tell my folks I feel it to be my duty to go and save my train, but after I do that I will try to get back to them as soon as possible"

He now pulled up on the "Albemarle," and Mr Goodwin needed no further signal to pull over the bridge, which, having passed, he took it slowly up the grades and around the heavy curve, where he had a view of the flying cavalry and pursuing enemy. When the "Albemarle" passed Afton a station four miles east of Waynesboro, some of General Lee's cavalry had already passed so rapidly did they [illegible]. It was only a few minutes to Greenwood where everything was on the move [illegible] full train of commissaries was [illegible] down our main track ready to go. Conductor Finks and Mr Goodwin were [illegible] to run in on the spur track to get [illegible] cars, which had been loaded with [illegible] at the depot

[illegible] about in there news came that the Yankees were very near, and the [illegible] could be heard The long train on main track pulled out. The switchman, in the confusion, threw the switch wrong and derailed one car, but Engineer Goodwin realizing the necessity of prompt action in order to escape, reversed his engine and gave her all the steam he had. Fortunately the car got back on the track [illegible] switch In double quick time the [illegible] consisting of three cars in front of the "Albemarle" and four behind was on the main track and headed east towards [illegible] tunnel Conductor Finks, who had changed the switch, pulled up on the engine, saying, as he did so "Bob, I am afraid they have got us" Mr Goodwin pulled cautiously out of the eastern portal and cut approach of Greenwood tunnel, and entering the open yard around the passenger office, exclaimed 'Great heavens! Josh, we are gone,' as he saw the Federal cavalry all about and around the depot and crossing. Conductor Finks, thinking, of course, that they were captured, jumped off from the opposite side of the engine from where the enemy could see him The fireman, Geo. Whiting (colored), and the brakeman, Jim Cowling, also colored, all jumped off. Mr. Goodwin followed Captain Finks to the steps of the engine with the intention also of jumping off, but suddenly changing his mind, he concluded to remain and run the gauntlet. In the meantime the engine was rolling slowly towards and getting close to the enemy Springing to the throttle, Mr. Goodwin attempted to open it wide and thus increase his speed and prevent the soldiers boarding the train The throttle being hard to open, his effort failed, and so he ran by the cavalry at a rate not exceeding fifteen miles an hour. After his effort to increase his speed failed, he fell to the footboard and stretched himself out like a lizard on a log in order to avoid being shot by a cavalry man, who by this time was riding by the side of the engine and trying his best to shoot Mr Goodwin. But the engine and tender received the seven carbine bullets which were intended for Bob. One bullet severed the cushioned seat, which was at this time unoccupied, and then punched a hole in the tank, but too high to waste much water

By the time the cavalryman had wasted his seven bullets the engine had arrived at a point where he could not ride further, on account of the termination of the high earth and stone platform leading from the passenger depot to the Dinwiddie Hotel, and upon which the cavalryman had ridden. Bob realized his advantage, and did not fail to make good use of it. He again jumped to the throttle, and having made a strong pull, had the joyful satisfaction of feeling the machine respond to his touch, and under a shower of curses from the cavalryman the "Albemarle" darted forward.

All old V C men remember the "Albemarle's" whistle, and when Bob got clear off he gave his would-be captors a loud and long farewell Mr Goodwin will always attribute his escape to a kind Providence, in whom he trusted, when he prayed as he did while the cavalryman's bullets fell harmless around him.

Any railroad man knows that an engine and seven cars, no brakesman, rolling down a seventy-five foot grade, will very soon attain a speed which is dangerous Mr Goodwin began to look around, realizing his still critical situation, and looking about for some of his crew, he saw a colored brakeman, a green hand, on the opposite side of the engine from where the firing had come, clinging on the side of the boiler and holding to the handrail. He was frightened nearly to death Then looking back in the wood on the tender he discovered Davy Spradling, the assistant depot agent at Waynesboro, who had secreted himself there to avoid capture. Mr. Goodwin soon had them both in the train and not a minute too soon, for it took a reversed lever, a full head of steam and all that the brakes could do to prevent a rear collision with the front train which had stopped in the mountain slope for wood After leaving Pierre, the train reached Mechum's River, a station fourteen miles from the eastern portal of Blue Ridge tunnel, and the foot of the grade being 1,000 feet lower than Afton, which is near the said tunnel Leaving Mechum's River still going east, Mr Goodwin encountered a pretty stiff grade rising Ivy hill.

He feared trouble, for he was out of sand. He soon became convinced that he would either have to cut loose and leave some of the cars there or be captured by Sheridan's cavalry, who were coming right along that way, the road which they took being in full view of where he stood spinning his drivers. He ran back, intending to cut off two cars of the rear of the train, but Captain Wren, who had charge of the commissaries, begged so hard that he should not do it, that Mr Goodwin concluded to try her once more, and see if he could, by using dirt on the track, by this means get her to pull the seven loaded cars up the grade. If he could have had sand, it would have been no load for the "Albemarle" With plenty of sand she could have pulled eighteen cars up the grade Mr. Goodwin became convinced that it was useless and dangerous to lose any more time, and so he was obliged to cut loose the two rear cars loaded with commissaries and leave them standing on the main line

When the Federal cavalry came by next morning they took off the brakes and let them roll on to Mechum's River Bridge, a structure 75 feet high and 300 feet long, and anointing bridge and cars with oil, burnt all to ashes Mr Goodwin rested awhile at Charlottesville, and then resumed his trip to Richmond, which he reached the third day from the time he left Greenwood, acting as conductor, engineer and fireman the whole way, 118 miles. Two young men who were assisting Captain Wren were killed at Greenwood as this train pulled away Mr Randolph J Albemarle and a Mr. McCreary Captain Wren and Mr McCreary were crouched behind an iron safe in one of the cars but Captain Wren said that McCreary lost his life by looking around from behind the safe to see what was going on against Captain Wren's caution.

Captain Finks was captured, but released by General Sheridan, after strenuous and persistent intercession of the citizens of Wayaesboro. According to the custom on both sides in those days, however, he had to forfeit his watch and boots.

Manning, Maxwell & Moore's Catalogue.

Several years ago Manning, Maxwell & Moore, New York, got out a catalogue of the tools and mechanical appliances handled by the firm, which probably was the most complete catalogue of this character ever published. This firm have now published an enlarged catalogue for 1894, which is as far ahead of the old one as it was superior to others. This catalogue is a volume of nearly 1,100 pages, 10 x 13½ inches, splendidly bound and filled with engravings and descriptions of all the tools and steam-engine appliances we have ever seen, besides a great many that are new to us. We know of a case where a railroad official was directed to make out an equipment of tools for large shops, a restriction being made on the money to be spent. He took the old catalogue of Manning, Maxwell & Moore, and used it as a guide, counsellor and friend, and is to-day enthusiastic about the help received. The present catalogue will be found perfect as a reference of this character. When a man wants to buy a tool of any description, large or small, he will find full particulars about it here. If he wants a tool for some operation that he does not know there is a tool for doing, let him examine this huge book, and he is certain to find what he wants.

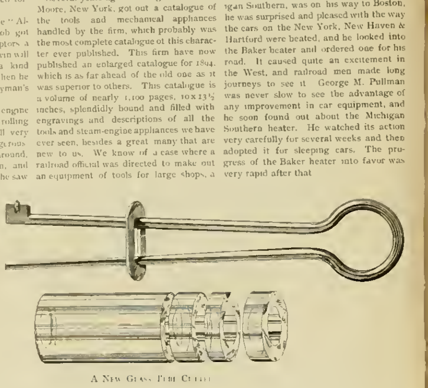
Growth of the Baker Heater.

The agitation in favor of safe methods of car-heating was carried on long before anything practical was done to dispense with the dangerous car-stove. Every accident that happened, which gave the red-hot stove the chance to burn up a car excited agitation for safer methods, but no one could see how a car could be heated by any other means. Besides its tendency to set fire to the car in case of accident, there were other grave objections to the stove, for it was an inefficient means of heating a car The space near the stove would be uncomfortably hot, while the parts farther away would be at a freezing temperature.

When the first agitation was at its height in favor of improved methods of car heating, Mr. William C. Baker was engaged in house-heating, and he conceived the idea that a car could be heated with hot water circulated from one heater that could be made strong enough to be safe. When he expressed his views to railroad men they dismissed him as a crank Those who made pretense to knowing something of natural philosophy, said that the man who proposed to circulate hot water downward did not know what he was talking about

In 1866, after much effort spent in convincing him that a hot-water method of car heating was practicable, the president of the New York, New Haven & Hartford consented to let Mr. Baker put a heater into his private car The work was done, but it took a great many changes before the heater was made to work satisfactorily. The president interested himself in what he perceived was a valuable invention, and was patient under failures, and made no complaint because changes were necessary. After persistent labor the heater was perfected, and it worked so well and gave so much satisfaction that it was applied to most of the cars belonging to the company.

One time that Mr Phillips, who was then general superintendent of the Michigan Southern, was on his way to Boston, he was surprised and pleased with the way the cars on the New York, New Haven & Hartford were heated, and he looked into the Baker heater and ordered one for his road. It caused quite an excitement in the West, and railroad men made long journeys to see it George M. Pullman was never slow to see the advantage of any improvement in car equipment, and he soon found out about the Michigan Southern heater. He watched its action very carefully for several weeks and then adopted it for sleeping cars. The progress of the Baker heater into favor was very rapid after that



A New Glass Tube Cutter

A New Gauge Glass Cutter.

The engraving shown herewith will make clear the general form of a new glass tube cutter just put on the market by Stannard & White, of Appleton, Wis.

The cutter is carried on one end of a spring steel wire, bent into the form of a split key. On the two ends of the wire slide a washer that serves to keep the ends together and as a gauge to cut to. There is no danger of applying too much pressure with this cutter, as the spring supplies all that is necessary. The cutter does its work on the inside of the tube. This little tool would be a first-class trick in any engineer's seat box

Saves Money, but Makes Grief.

A drummer who was an old engineer walked into an engine-house belonging to the New York Central and began questioning the foreman about the various engines "I see you are using brick arches," he remarked, "do they save fuel?"

"Do you know anything about locomotives?" answered the foreman, looking furtively at the plug hat of the drummer.

"Well, I've run an engine in my time, but she had no ornament of that kind in her firebox."

"Now, friend," said the foreman, "you may be a master mechanic or a general manager. If you are, and are trying to find out something about brick arches, I can give you a pointer. If your coal is very expensive, you will save money by using a brick arch. If you object to seeing the black smoke roll out like ink from the top of the smoke stack, the brick arch will help your firemen to keep that stream white, but it will give you so much grief in other directions that you will wish the words saving and smoke prevention had never been invented."

The fifty-five passenger cars for the Long Island Railroad have gone to Pullman

Car Shops and Car Builders.

Growth of the Sleeping Car.

Referring to the facts recently published in Locomotive Engineering concerning early sleeping cars, a correspondent who is exceptionally well informed on historical railroad matters says that there were a great many attempts to establish sleeping car service long before Mr. Pullman made the business a commercial and mechanical success. The long railroad journeys that became possible on this continent more than forty years ago stimulated inventors to design cars in which travelers could obtain rest and sleep at night. Most of the early inventors made modifications of the sleeping berths found in steamboats, most of them having provision for converting the berths into seats for day use. The sleeping arrangements, on the whole, were satisfactory enough and were a great improvement to tumbling about in a seat all night, and travelers who enjoyed the privilege of a bed in a car acknowledged that a system of sleeping cars that did not entail change of car at the connecting point between different railroads was greatly needed. Railroad companies that attempted to introduce sleeping cars did not make a success of the business. The managers appeared to have enough to do without devoting special attention to what was regarded by many as a dangerous innovation, and the sleeping car service was neglected. A magnificent source of revenue was lost through the short-sighted policy of men who were afterwards the first to denounce the robbery of railroad companies by owners of sleeping cars.

The Pullman Palace Car Company turned out to be as heartless a corporation as ever abused public confidence, but to its head the traveling public is indebted for the comforts now enjoyed during long journeys. George M Pullman was a mechanic who could devise ingenious methods for converting a day car into an array of comfortable beds. In addition to this he was a man of affairs, who perceived how sleeping cars might be operated upon a business basis. On charges for berths which had ruined others he built up a lucrative business. The leading railroad companies of that day ought to have worked up a sleeping car business as part of their passenger train conveniences; but they failed to do so, and private enterprise sowed the seed and reaped a rich harvest.

The first two sleeping cars constructed according to Mr. Pullman's plans were built by the Chicago & Alton Railroad, at Bloomington, in 1859. The work was done under the supervision of Mr. David Shields, who was then master car builder of the road. Mr. Joseph Townsend, now master car builder at Bloomington, was a foreman in the shop at the time, and attended to the details of the work When the cars first went into service, Mr Pullman ran with one of them as conductor, and in that capacity began studying the methods required to make the business pay. He was greatly in favor of increasing the comfort of passengers, and making the beds of a character that would attract patronage. When the success of the sleeping car business on the Alton was assured, some new cars were ordered from the Wason Mfg. Co., and they were considered marvels of luxury and comfort. The first one cost $5,000, which was then considered an enormous sum to pay for one car. It paid even as an advertisement, for it excited as much attention as the latest development in the sleeping car line excited at the late Exhibition. Pullman gave the cue in 1860, and luxurious furnishings have been on the increase ever since

The Wagner sleeping cars came later, and their style of construction and methods of operating followed after Pullman. The leading features of the cars did not admit of being secured by foundation patents, and so the style of berths were not materially different in any of the sleeping cars that were brought out as rivals to the Pullman. After the Pullman Company became prosperous, there was, for a time, an epidemic of new sleeping car companies, but none of them ever amounted to anything except the Wagner, which was under the Vanderbilt protection and encouragement It is a close corporation, most of the stock being held by members of the Vanderbilt family. Wagner cars are now as good as Pullmans, but for many years the cars were very inferior and the service worse. The service is still open to improvement.

Smoking-room in Chair Car, St. Charles Car Works.

Parlor Car Interior, St. Charles Car Works.

Special Shop Tools.

One of the subjects on which a report will be submitted to the next convention of the Railway Master Mechanics' Association is "Special Shop Tools." There have been reports repeatedly submitted on shop tools, but they generally dealt with the latest improvements in machine tools, and contained little that could not be learned by an examination of a good descriptive catalogue. The subject to be reported on at next convention is of much wider scope and is likely to contain information of a highly valuable character. The chairman of the committee is Mr. T W. Gentry, who is one of the hardest working members of the Association, and a man who has done as much as any one we know to design the appliances which we look upon as special shop tools.

Some railroad shops are celebrated for the variety of special appliances contrived to facilitate work or to secure increased accuracy. There are few shops to be found where there is not some labor-saving device in use, devised by an ingenious workman or inventive foreman. A curious thing about these appliances is, that they may be used for years in one shop without others knowing anything about them. The people using them get to look upon the articles as common because they see them every day, when all the time they would be considered the greatest novelties if seen by strangers.

The peripatetic mechanical journalist has done a great deal to bring ingenious shop kinks and convenient small tools into public notice, but there are still hundreds of these that flourish unseen in obscure tool rooms and in the recesses of machinists' tool boxes. When the writer goes through a railroad shop with a master mechanic, master car builder or foreman, he always asks if they have any special tools or shop kinks. Sometimes he will be taken to look at a fine turret lathe or a wheel-boring mill of the newest design, or a wood-working machine with wonderful capabilities, but ingenious minor tools are seldom shown, and they have to be discovered by patient search.

These minor special shop tools and special methods of doing work are what the Committee ought to investigate most thoroughly and make known to the Association, and through that to all railroad men interested. There are many simple devices that would be greatly aided if they were only generally known, and railroad companies would profit much from their introduction into general use. The Committee has sent out a circular calling for information about special tools for railroad work, which ought to receive careful attention. We consider this subject of importance second to none that will come before the convention.

The electric trolley is threatening railroads with competition in a new form. As a means of transmitting power to street railroads it has seriously crippled the suburban business of many railroads, and it has now been applied to supplying power for the propulsion of canal boats. An experiment was made on the Erie canal last month with a boat having a screw propeller operated by a dynamo, to which electricity was conveyed through a trolley system. The work was done by the Westinghouse Electric Company and was perfectly satisfactory. The indications are that the practice is going to be reversed and that the trolley will kick the festive mule off the canal path.

C. M. & St. P. Slee[illegible] St. [illegible] Car Works.

Am[illegible] Day Coach, St. Charles Car Works.

Inventing Car Couplers.

A peculiarity about the invention and patenting of car couplers is that the greatest part of the applications to the Patent Office go from small country towns where there are no railroad shops or establishments engaged in car building. The origin of a great many of the inventions is that a man of an inventive turn hears about the injury and destruction to life that is caused yearly in the work of coupling cars, and he proceeds to design a coupler that he supposes will work automatically. He has not any idea of the real requirements of a car coupler, but he is intent principally upon getting up something which will couple with another of the same form when both come together on a straight line. This is the origin of so many link and pin couplers being patented long after those of the vertical type have been made standard.

The inventors in numerous instances do not know what a vertical plane coupler is. They get the inventing idea into their heads and work it out by examining the couplers of the cars they find standing on side tracks. The link and pin coupler is still in the majority, and the rustic inventor naturally supposes that the majority is the side he ought to keep in with. The consequence is that the Patent Office continues to receive a good revenue every month from the inventors of car couplers of a form that no railroad company will ever apply to a single car.

Repairing Freight Cars by Piece-Work.

Schedule of Prices Paid for Labor by one of the Large Lines.

For some years past several of our large roads, including the Pennsylvania, and quite a number of the private car lines have adopted the piece-work plan for running repairs to cars. Not only do they pay their own car repairers the fixed price for work done, but they let out their repairs to contract shops on the piece-work basis.

Material fluctuates in value, and it is found necessary to separate material from labor, making a price for labor and another for material, and this is done in every case that we know of.

The plan followed by a well-known private car line, which has its general repairs done in a contract shop, is to make a monthly agreement about prices of certain specific parts, and then have the following general rule, covering all material not enumerated in the monthly price list.

MATERIAL.

"All new materials to be charged at market rates with an addition of 10 per cent.

"Proper credit must be allowed for all scrap and good material removed from every car—such credits *to be deducted from the charge against the car from which they were removed.*

"When second-hand material, in good condition, is re-applied it shall be charged against the car at the same price for which credit was given the car from which it was removed, with 10 % added.

"All scrap to be credited at market rates and second-hand wheels and axles, fit for further use, shall be credited according to the Master Car Builders' Association Rules."

Each month the contractors fill out a blank price list of material as given below this states from what day in a certain month to another day the prices are to hold, and changes in the market price of material during that time does not affect the price list—both sides know what they are doing, and have to do.

PRICES OF MATERIAL, ... 189 , to 189

Axles, steel, per 100 lbs.
" iron, " " "
Butler draw-bar attachment, each
Bar iron, flat, per 100 lbs
" " round, per 100 lbs
Bolts, " " "
Chain, " " "
Cast iron, " " "
Draw-bars, M. C. B. yoke, each.
" cast iron, link pin (with tail bolt), each.
Draw-bars, malleable iron, link pin (with yoke), each.
Dust-guards, each.
Flooring, per 1,000 ft.
Forgings, per 100 lbs.
Hickory, per 1,000 ft.
Journal bearings, per 100 lbs.
Lag-screws, each.
Malleable iron, per 100 lbs.
M. C. B. knuckles, (steel), each
Nuts, tapped, per 100 lbs.
Nails, wire, " " "
" cut, " " "
Oil, lubricating, per gallon.
Oak, per 1,000 ft.
Paint, ready mixed, per gallon.
Rivets, per 100 lbs.
Springs, draw-bar, each.
" truck elliptic, each.
" " coil "
Southern pine, per 1,000 ft.
White " " " "
Washers, cast, per 100 lbs
" wrought, per 100 lbs.
Waste, " " "
Wheels, 550 lbs., each
" 600 " "

NOTE.—The above prices include the [illegible] per cent. over actual cost. All materi[illegible], timbers, forgings, castings, paints, etc., shall be of the best quality, and all work must be done in a substantial and workmanlike manner, subject to proper tests and inspection.

Air-brakes to be repaired at actual cost of labor and material, plus 10 per cent.

All tenons to have one coat of paint.

Prices for labor are contracted for by the year, and the prices given in this article have been found very satisfactory, being the results of some two years' practical trial. The line finds that their cars are kept in good condition for much less money than they formerly spent in a shop of their own, while the contracting firm are well enough satified with the arrangement to be glad to sign a long contract.

PRICES FOR LABOR, FLAT CAR BODIES.

Body bolster, plain or combination (with one coat paint), removing and replacing—1 complete	$1 50
Body bolster, plain or combination (with one coat paint), removing and replacing—2 complete	2 75
Body center plate, removing and replacing—1 complete	50
" " " " " 2 "	1 00
" side bearing (friction) removing and replacing—1 complete	25
" " " " " 2 "	50
" " " " " 3 "	75
" " " " " 4 "	1 00
truss rods, removing and replacing—each complete	25
" " washers, removing and replacing—each complete	10
" " bearings, "	15
" " saddles, "	20
" " turnbuckles, "	10
Bolts, miscellaneous, not included in other work, removing and replacing—each	5
Brake ratchet wheels, removing and replacing—each complete	5
" " pawls, "	5
" shafts, "	25
" chains, "	10
" steps, "	15
" wheels, "	10
" shaft bearing, "	15
Body bolster truss rod, "	..
" " " washers, removing and replacing—each complete	
" " " saddles, "	
" " " end plates, "	
Buffer blocks, removing and replacing—each complete	20
" " plates, removing and replacing—each complete	20
Butler attachment, "	50
Coupling pin, complete, removing and replacing—complete	10
" chain or link, " each	5
Coach screws (lag screws) " complete	5
Car steps, "	10
Cross tie timbers, "	60
Center pins (or king bolts), "	25
Head blocks, removing and replacing—each complete	20
Draw bars, link and pig-tail bolt, removing and replacing—each complete	25
" yoke, link and pig-tail bolt, removing and replacing—each complete	50
" vertical hook, removing and replacing—each complete	50
" carry iron, "	15
" follower "	20
" " guide, "	10
fill block, "	30
" springs to tail bolt bars, removing and replacing—each complete	25
springs to yoke, draw-bar, "	50
stops, "	15
" bolt, "	25
plunger, "	25
" " spring "	25
" guides, "	10
Draw-rods, "	25
timbers, "	75
" stiffeners, "	30
" pockets, "	50
" tie-rod, "	10
" nut locks, "	5
" guard, "	5
Flooring (with necessary painting) " per board foot	2
NOTE.—In cases where flooring has been destroyed in tearing up for repairs to sills, etc., no labor charge shall be made for relaying new flooring	
Hand rail stakes, removing and replacing—each complete	10
" " holders, "	15
Nuts, not included in other work, applying new, each	1
Nails, " " " " per pound	2
Sill, side (with one coat paint, side and top, lettered and numbered) removing and replacing—1 complete	3 50
Sill, side (with one coat paint, side and top, lettered and numbered), removing and replacing—2 complete	6 00
Sill, center (with one coat paint on top), removing and replacing—1 complete	3 50
" " " " 2 "	6 00
Sill, intermediate (with one coat paint on top), " 1 "	3 50
" " " 2 "	6 00
Sill, end (with one coat paint), " 1 "	1 50
" " " 2 "	3 00
Short stringers, " each complete	1 00
Washers, wrought or cast, " each	1

TRUCKS.

Arch bars—top, removing and replacing each complete	$0 75
" bottom, removing and replacing each complete	75
Bolts, miscellaneous, not included in other work, removing and replacing each	5
Bolster guide-bars, removing and replacing 1 complete	50
" " " " 2 "	1 00
" " each additional one—complete	50
guide-blocks, removing and replacing 1 complete	25
" " " 2 "	50
" each additional one—complete	25
Brake-beams (with one coat paint) removing and replacing—1 complete	50
" " " " 2 "	1 00
" " " " 3 "	1 50
" " " " 4 "	2 00
Brake connections—top, removing and replacing each, complete	10
" " bottom, "	15
" hangers, "	10
" heads (or blocks), "	20
" shoes, "	10
" levers, "	25
" safety chains, "	15
" safety hooks, "	5
" jaws, "	25
" beam guides or pins, "	10
" hanger hooks, "	10
" head key (Christie), "	10
Center plate, " 1 "	1 00
" " 2 "	2 00
Coach screws (lag screws), " each	5
Dust guards, "	10
Journal boxes, "	50
" " covers, "	10
" bearing, "	10
" " key, "	10
" boxes, oiling and packing, each	5
Nuts, not included in other work—applying new, each	1
Raising pieces (to truck spring), removing and replacing or applying new, each complete	40
Springs, elliptic removing and replacing—1 complete	1 25
" " " 2 "	2 50
" " " 3 "	3 75
" " " 4 "	5 00
Springs, coil, removing and replacing—1 complete	$1 25
" " " 2 "	2 50
" " " 3 "	3 75
" " " 4 "	5 00
Side bearings, 1 "	50
" " 2 "	75
" " 3 "	1 25
" " 4 "	1 50
Spring beams (with one coat paint) removing and replacing—1 complete	3 00
" " " " 2 "	6 00
Tie-bars, removing and replacing—2 complete	35
" each additional one, complete	35
Truck bolster, plain or combination (with one coat paint), removing and replacing—1 complete	2 50
Truck bolster, plain or combination (with one coat paint), removing and replacing—2 complete	5 00
Truck-bolster truss-rods, removing and replacing—each complete	50
" " saddles, removing and replacing—each complete	50
" " plates, "	50
" " complete, applying to bolsters not so equipped, per bolster	1 50
Wheels—Labor removing from car one pair wheels, removing wheels from axle applying wheels to axle and placing under car, complete	1 62
Washers—Wrought or cast, removing and replacing, each complete	1

SWING-MOTION TRUCK.

Swing hangers, removing and replacing, each complete	$0 25
" " pin, "	10
" " bearings, removing and replacing, each complete	25
" " keys, "	5
" safety straps, "	25
Transom tie straps, "	50
Channel irons, "	[illegible]
Transom end casting, "	1 50
Friction plate, "	27
Truck side, "	2 50

LABOR ON BOX-CAR BODIES.

Braces, box car, removing and replacing—each complete	72
Belt rail, " " per section	48
Carlins, " " each complete	72
End plate, " " "	72
Flooring, " patching of—per board foot	2
Lining, " "	3
Posts, " removing and replacing—each complete	65
Purlins, " "	50
Roofing, " patching of—per board foot	[illegible]
Running boards, box car, removing and replacing—per car complete	75
" " " patching of—per board foot	[illegible]
" " saddles, box car, removing and replacing—each complete	5
Side plate, box car, removing and replacing—each complete	4 50
Siding, "	3
Sill, side, " 1 "	6 60
" " " 2 "	13 20
Sill, center " 1 "	[illegible]
" " " 2 "	[illegible]
Sill, end, " 1 "	1 50
" " " 2 "	3 00
Sill, intermediate, box car, removing and replacing—1 complete	[illegible]
" " " 2 "	[illegible]
Side door, " each	2 50
Trap, " "	1 00
Doors, patching of—per board foot	03
Corner plates, removing and replacing—each complete	44
Door hasps, "	05
" handles, "	05
" slides, "	40
" shoe, "	10
" stop, front, "	15
" " back, "	9
Flooring, patching of—per board foot	2
Facia, "	2
Ladder, wooden, removing and placing—each complete	[illegible]
" step, "	10
Roof handles, "	10

MISCELLANEOUS LABOR.

Tightening all nuts on body	$[illegible]
" " 1 pair trucks	25
Painting body, 1 coat paint, lettering and numbering	[illegible]
" " 2 " " "	[illegible]
Tearing down body	[illegible]
" 1 pair trucks, and removing all defective wheels from axles	[illegible]
Removing 1 pair trucks from car (for other purposes than repairs)	1 00
Replacing 1 " under car " "	[illegible]

RATES OF LABOR CHARGED FOR REPAIRS NOT IN SCHEDULE.

Blacksmiths, per hour	$0 [illegible]
" helper, "	20
Boiler-makers, "	40
" helper, "	20
Machinists, "	40
Pipe fitters, "	30
" helpers, "	17½
Car repairer, "	25
Painter, "	25

The bills rendered have every item here enumerated printed in both for labor and material, and are themselves an excellent record of repairs, as by a glance at any one month's bills the responsible officer can see just what parts of his cars are giving him the most trouble, and if he finds, month after month, that he is breaking dozens of tail bolts, he can make provision for larger bolts or yokes.

But the main beauty of the plan is that the owners of the cars pay for actual work done on it and for actual material put into it. There is a profit of 10 per cent. allowed on all material, and this is expected to handle it, insure and provide for the shrinkage. If a shop manager is getting paid by the piece for actual work done, and his men are getting paid largely for going to and from supplies, tools or work, he will find means for reducing the loss and making every move count, that he would not have thought of before.

In some of the shops doing this kind of work the men still work by the day, but able foremen plan their movements, and introduce short and cheapening methods. The tendency is, however, to put the men on piece-work, then every man in the place is seeking to improve processes. The great bane of piece-work is the greed of those having charge. They interest the men, and get them to producing 50 per cent. more work with 10 per cent. more pay, and then cut them down. Piece-work prices should be agreed upon between workmen and employer once a year, and the price left alone for that time. Then all prices should be based on the percentage of increased production.

Any good mechanic interested in his work is worth to his employer at least 25 per cent. more when working piece-work than when working by the day, and no employer should begrudge it to him. If he don't produce more than 25 per cent. more, he is not the man wanted.

In looking at the pay-roll, railroad officials often forget that there are any other records in the office. If piece-work has been introduced, see what extra results have been accomplished by the same men with the same tools in the same shop.

Indicator Diagrams from Union Pacific Locomotive.

The indicator diagrams shown on this page illustrate the work done by passenger engine "844," belonging to the Union Pacific, while pulling a train over the division from Omaha to Grand Island, the profile of which accompanies the diagrams. The engine was built at the Omaha shops under the supervision of Mr. J. H. McConnell, superintendent of motive power, and the dimensions and proportions represent his ideas of what form of locomotive is best adapted for the work to be done. The engine is of the eight-wheel type, and has cylinders 18 x 26 inches, and driving-wheels 69 inches outside diameter. The boiler is of the wagon-top form, with crown-bars supporting the crown. The boiler is very substantially made, and carries a pressure of 180 pounds to the square inch.

In speaking about the engines, Mr. McConnell says that he has done all in his power to make the exhaust passages as large as possible, and that this policy is followed with all the locomotives on the road. The effect of this can be seen on the diagrams, which are noted for the small amount of back piston pressure. Engines of this class pull a train of six or seven passenger cars from Omaha to Denver, a distance of 569 miles, in fourteen hours, making nineteen stops. They make time with this train very regularly.

The diagrams were taken with a Tabor indicator, spring 80 pounds to the inch, and represent the work done by one side of the engine. The cards show a remarkably good distribution of steam, with very little more to be desired in the way of expansion. An engine working along for a whole day using the steam in the fashion shown by these diagrams, leaves little opportunity for improvement by compounding, for the steam is exhausted as close to atmospheric pressure as the necessities of maintaining draft on the fire will admit of.

A criticism that readily occurs to one analyzing the diagrams is that the valves were not very well set, and the work done on the forward and back strokes is not so uniform as it might be. A difference of more than an inch on one side, when the steam is cut off at nearly half stroke, is too much. The saddle-pin needs to be set back a little or some other adjustment made.

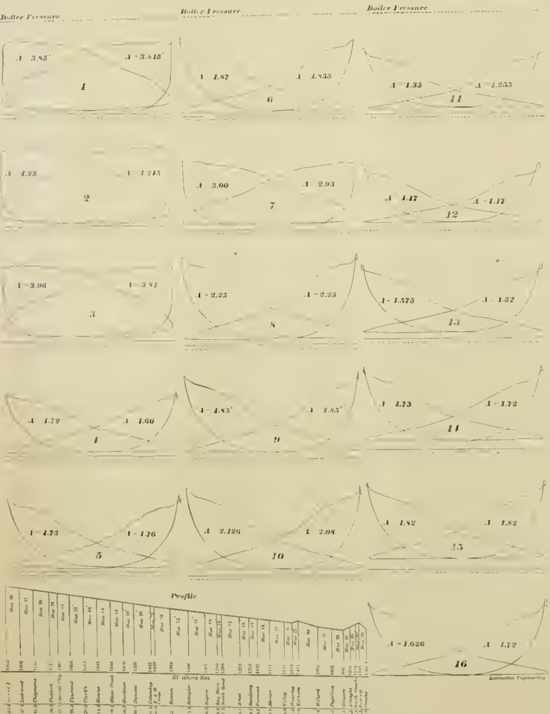
A characteristic about the diagrams that we do not like is the low initial cylinder pressure of the steam. The average boiler pressure when the diagrams shown were taken is 173 pounds, and the average initial cylinder pressure is 125 pounds, an average drop of 48 pounds, equal to 28 per cent. This is due to the vicious practice of throttling the steam, which is apparent in all the diagrams. There may be some reason why locomotives on the Union Pacific should be worked habitually with the throttle nearly closed. It may be that the alkaline feed water causes the steam to come through the steam pipe so wet that an advantage is obtained by throttling, which induces some superheating. If the water used on the division between Omaha and Grand Island is good enough to make steam that has no tendency to prime, the way this engine was worked led to considerable loss in the use of steam.

There is nothing more definitely settled in steam engineering than the loss due to throttling of steam. We should calculate that the loss in this engine would reach 20 per cent. There was no excuse for this, because the reverse lever is finely notched, so that the engineer can set the lever to suit the call for power. Take, for instance, diagram 4. Here the reverse lever is in the twenty-eighth notch and the cut-off and 8 inches, the throttle valve being $\frac{8}{32}$ inch open. There is every reason why the lever should have been hauled back so that the cut-off should take place 2 inches earlier, and the throttle valve opened out. This change would have produced as large a card with, perhaps, 25 per cent. less steam. Nearly all other cards are open to similar objections.

It is evident that the engine has been well designed for doing work economically. She was not handled to make good use of the steam, but circumstances, and not the engineer, may be to blame for this.

PARTICULARS OF DIAGRAMS.

No. of diagram	Speed in miles per hour.	Revolu'ns per minute	Boiler pressure in pounds	Initial cylinder pressure	Mean cylinder pressure	Opening of throttle In.	Cut-off forward end of cylinder In.	Cut off back end of cy'der In.
1	20.8	101	165	125	83.2	$\frac{7}{32}$	$14\frac{13}{16}$	$13\frac{7}{8}$
2	18.3	88	175	133	91.2	$\frac{7}{32}$	$14\frac{13}{16}$	$13\frac{7}{8}$
3	25	118	175	125	84	$\frac{7}{32}$	$14\frac{13}{16}$	$13\frac{7}{8}$
4	41.6	203	175	103	35.84	$\frac{8}{32}$	$9\frac{5}{8}$	$8\frac{1}{16}$
5	50	243.4	180	125	37.6	$\frac{6}{32}$	$8\frac{5}{8}$	$7\frac{1}{16}$
6	45.8	228.7	175	133	40	$\frac{7}{32}$	$8\frac{5}{8}$	$7\frac{1}{16}$
7	29	141.2	175	115	64	$\frac{8}{32}$	$12\frac{13}{16}$	$11\frac{7}{8}$
8	41.3	200.4	175	145	48	$\frac{7}{32}$	$8\frac{5}{8}$	$7\frac{1}{16}$
9	58.3	284	170	137	40	$\frac{1}{4}$	$8\frac{5}{8}$	$7\frac{1}{16}$
10	54	263	175	145	45.4	$\frac{1}{4}$	$8\frac{5}{8}$	$7\frac{1}{16}$
11	62.7	300	175	102	28	[illegible]	$8\frac{5}{8}$	$7\frac{1}{16}$
12	62.7	300	170	100	25.5	[illegible]	$8\frac{5}{8}$	$7\frac{1}{16}$
13	62.7	300	170	115	33.4	$\frac{8}{32}$	$8\frac{5}{8}$	$7\frac{1}{16}$
14	62.7	300	165	130	37.28	$\frac{1}{16}$	$8\frac{5}{8}$	$7\frac{1}{16}$
15	51.4	250	180	140	39.36	$\frac{1}{16}$	$8\frac{5}{8}$	$7\frac{1}{16}$
16	45	219	175	133	36	$\frac{1}{16}$	$8\frac{5}{8}$	$7\frac{11}{16}$



Every year after the Interstate Commerce Commissioners' report comes out it becomes the text for whimsical statisticians to figure out and expatiate upon the number of miles a man must travel in a railroad train before his time for meeting an accident comes round. It is no doubt very amusing for the people who like that kind of amusement to pursue that kind of figuring, and it may reassure some timid people that their time for getting killed is still far distant, but calculations of that character are despised by those who understand how accidents happen. The average number of miles traveled by each person between accidents proves nothing. They do not indicate where accidents are common and where they are rare. Sensible people had better not to depend upon the general average, but rather to watch the railroads where accidents are rare, and travel by them in preference to the roads where accidents are of frequent occurrence. There is close relation between good rolling stock, good signals and the most approved methods of operating, and the exemption from accidents.

A new purpose has been found for anti-friction rollers. James Clayton, of Brooklyn, N. Y., has applied them to valve eccentrics and patented the arrangement. The eccentric is cast with cavities, which are open at the periphery of eccentric. Anti-friction rollers are fitted into the cavities and the eccentric strap rests on them. This is not open to some of the objections raised to anti-friction bearings for cars.

*Railroad Coppersmithing—V.

By John Fuller, Sr.

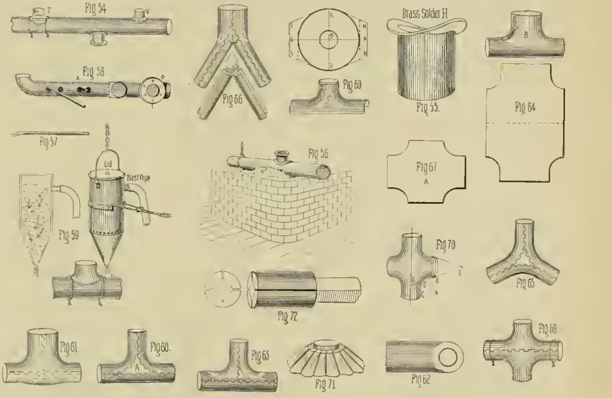
OUTLETS.

We will now turn our attention to outlets, which it is often necessary to construct to convey water or steam in some direction other than in the direct line of a main. These are made, placed and secured in position in two ways as a rule, that is, they may be riveted and soft soldered, or they may be brazed after having been properly prepared and fixed in their positions, as the circumstances of the case requires. In some kinds of work where it is necessary to have outlets, such as that used in breweries, they are more often soft soldered in their positions than hard soldered; but in marine and locomotive work, as a rule, they are all hard soldered, excepting those which are worked out and formed from the material of the main pipe, which can be of any size to suit the requirements of the job in hand, up to the size of the main pipe it is to lead from. We will suppose, in the example before us, Fig 54, the pipe is 7 inches in diameter, and an outlet 4 inches in diameter is required at the point *V*. A short piece of pipe of the length required to form the outlet is cut to fit the pipe, the outlet being previously drawn out a little at the bottom end, the edges are then filed and rounded up smooth and free from cracks, and a flange from ½ to ¾ inch wide is laid off from the bottom edge, the flange being next nicely fitted close to the main pipe. The hole in the main pipe is cut out about ½ inch smaller than is required to be when finished, and a burr is worked out from the main pipe, as shown at *T*, and made to stand up ¼ inch inside the outlet when it is placed on the pipe. Let the burr fit close and snug on the inside of the outlet, and the outlet flange fit nicely down on the main pipe. When the outside flange has been fitted, clean the place it is to occupy, either by filing or by the heating process, using salt and water pickle before making hot, also clean the outlet in the same way.

When this is done, spread an even coat of fine spelter on the flange of the outlet on the inside of Fig. 55, letting it extend as far into the outlet as the burr of the main pipe is likely to reach, as at *H*. Now, take it to the fire and run the solder just hot enough to run smooth and evenly all round the flange. (This is to answer the same purpose that tinning does when making soft solder joints.) When done, cool it in clean water. The face of the flange should look now like a piece of fresh clean sheet brass. Place the outlet in position and wire it fast to the main pipe. It may now be brazed on the brick forge, Fig. 56, by laying solder ½ inch wide, more or less, around the joint, one-half of which should be on the outlet flange and the other on the main pipe, heat the main pipe slowly until it is blood red in the shade; by this time the borax and spelter on the joint should have the appearance as if varnish was among the spelter, caused by the melting of the borax. Now, offer the solder to a moderate brisk fire of sufficient power to make it run and flow with ease, filling the joint right through to the edge of the burr inside. If, however, the job is of such a nature that it is inconvenient to handle at the brick forge on account of size and weight, or some other contingency, a balloon fire may be brought into service with advantage, and by its agency the fire may be taken to the work instead of taking the work to the fire, as in Fig. 59. This firepot is called a balloon firepot, from its similarity to a balloon. It is made of ⅜ boiler iron, and usually about 12 inches in diameter and 12 to 14 inches long, with a conical point at the bottom, at the end of which is an opening about 2½ inches in diameter, through which the flame is driven by the blast, which is conveyed from the supply-pipe to the firepot by means of a hose or other pipe. The cover is a flat piece of heavy boiler plate. Before using this firepot it must be lined on the inside with about ½ inch of fire clay.

The work is first made ready for this fire by heating it as near as can practically be done to a red heat, so that the pot may not have to supply too much heat to the parts which surround the joint, but that all its power and intensity may be concentrated on the point where it is required and most necessary; when this instruction has been carried out the work is ready to proceed. The pot having been previously hung in position to the traveler, it is now filled with live hot coke, which is made to lie close and compact in the pot; when all is ready it is brought to the joint and the fire with a brisk blast is thrown on the spelter, which will quickly run if it has been properly handled and kept in condition with a sufficiency of borax, and the parts adjacent to the joint have been kept hot.

Outlets intended to be soft soldered should be fitted with the same care as are those for brazing, and may be riveted as at *V*, in Fig. 54, in addition, in some cases this is quite necessary and should not be omitted. To work outlets from the main pipe, which it is sometimes better and more convenient to do, we proceed as follows. On the pipe, Fig. 58, at the point where the outlet is to be, measure off the distance equal to one-half the circumference of the outlet required; from the two extremities of this half circumference and between them, measure each way a distance equal to the turn to be made for the flange *I*. Now drill two small holes, and with a file round up the edges of the holes smooth; then make the part red hot and insert the burring pin, Fig 57, and with the bent end jar or drive out the collar while the pipe is yet hot; when it is out as far as necessary, slit it down between the holes as at *A*, Fig. 58, and open it out easy until completed as shown. Care must be taken to file the edges of the outlet up round and smooth and keep them that way, so that no rough burrs be left on. With ordinary mechanical ability and a little close attention an outlet can be worked out from the main pipe long enough to get a flange on, as shown at *I*, Fig. 58, by which to make connections with other pipes. This makes a good job.



TEE PIECES.

Tee pieces are made in several ways to suit the job they are to be used for, but there are only two in common use as a general rule. These are when the three passages are all one size, as in Fig. 60, and when the inlet is equal to the two outlets, or the reverse, as in Figs. 61 and 62. The first is formed by making two saddle pieces, a cap or bottom piece, and a gusset, *A*, as in Fig. 60. This piece of work would look better without a gusset, as in Fig. 63, which can be done by leaving the corners on the saddle pieces and squaring them up before putting together, but there is the advantage of economy in favor of the gusset, as there is always a good supply of pieces available in all shops. The tee in Fig. 61 is formed of two taper pieces, the large end being equal to one half the circumference of the inlet at one end and half the circumference of the outlet at the other. This can be made with or without a gusset, as desired. The stem or large end should be kept the same thickness or diameter right through to the bottom cap, and the other two taper off as if two frustums of cones were joined together at the base, the small ends having a short distance of them parallel from the end for the flange to fit on, to make the necessary connections with other pipes. I have made small tees from one piece cut from the sheet, as in Fig. 64, by working down the throats or saddles into shape with a razing hammer, and forming the two outlets by bending the pattern in the middle and bringing the two edges together. The stem is thus in two halves, while the part forming the two outlets is one continuous piece, having the seams in the two throats, as shown in *B*, Fig. 64. There is no reason why a large tee should not be made in the same manner with economy in labor, but I never made a large one this way nor saw one made; we *must* go on according to custom

THREE-WAY PIECES.

Three-way pieces are similar to tee pieces; the difference, however, is in the form of construction, as will be seen by reference to Fig. 65. Here, it will be noticed, they are made by putting together three saddle pieces and a gusset, the branches being an equal distance apart and usually all of one size. It is sometimes necessary, as in the case of tees, to have one branch equal in area to the other two, like a britch piece.

BRITCH PIECES.

Britch pieces are similar to three-way pieces, the difference in their construction being that the area of the stem is equal to that of the other two branches, as shown in Fig. 66. Britch pieces are made of pieces similar to those described for Fig. 61, excepting the crotch piece at the bend or turn is cut a third through on each side, as shown, and a gusset, *A*, cramped in the turn and brazed; then the other two side pieces are thinned, cramped and brought together and wired, the seam dressed down and chattered loose, then brazed.

CROSS, OR FOUR-WAY PIECES.

Small cross or four-way pieces are made similar to three-way by joining four saddle pieces together with a gusset, unless some special purpose calls for another method. In large work, two ways are adopted, according to the skill of the workmen engaged.

The first by cutting out two pieces, as shown in Fig. 67, and razing down the throats and making the four joints by cramping the pieces together in the four throats or saddles, and brazing. The other by making it in two halves, with the seam on the side and cramping together, as shown on Fig. 68. To do this with the least amount of labor, we must reduce the surface of one-half of the piece to a flat sheet of metal, as in Fig. 69, proceeding as follows. From the point *A*, Fig. 70, with the radius *A B*, describe the arc *B C*, divide *B C* into three equal parts, through the two points *B D* of one of the parts draw the line *G E*, on the opposite side of the figure draw *E H*, similar to *G E*; then *B I H G* will represent a frustum of a cone. Now find the convex surface of a frustum, which is thus represented. Let *B I H G*, Fig. 70, be a frustum of a cone, and let $I B = 3$ and $H I = 4$ and $H G = 5$. Then the convex surface of the frustum =

$$\frac{3+5\times 3.1416\times 4}{2}=50.2656,$$

and converting this into circular or disc inches we have

$$\frac{50.2656}{0.7854}=64.$$

Now add the square of the diameter *B I* and $3^2 = 9$; then $64 + 9 = 73$, the convex surface of *B I H G* in circular inches, extracting the square root we have

$$\sqrt{73}=8.544$$

or a disc of sheet metal 8.544 in diameter, as in Fig. 69. Draw the line through the center *O*, and from the points *P* and *G* draw the lines *N M P* and *S G V* at right angles with the diameter *P G*, and meas-

... off from the points P and ... fourth of the circumference of I R, Fig. ... Now draw the lines M N and U S a distance from the circumference of the circle equal to the length the straight part is required to be at the ends, join R M and U N, and R I and U S, which are tangent to the circle. Then the pattern I S M N, Fig. 69, will equal approximately the surface of I, Fig. 69. Having cut out two pieces of sheet copper like the pattern, Fig. 69, they are ready for forming after the edges have been rounded up with a smooth file. Begin this process by wrinkling or puckering as in Fig. 71, then with a razing hammer, Fig. 33, raze down the wrinkles on a suitable mandrel, Fig. 72 (secured in the man... block or a bench strap), to form the ... and when it is of sufficient length ... the two ends to form the cross-way.

Practice and experience only can supply the place of an instructor when making the turn. Care must be taken during the working not to press the metal too severely, ... work it when it is hard, but anneal it at the close of every course, when it has been properly formed, the surplus stuff can be trimmed off from the edges and the edges thinned from the inside. Now, take the crown out of the cone, about ½ inch from the edge, round up the edge with ... file free from rags and chisel marks, and ... out the edge level with, and forming part of the outlet, thus extending the length that much further. It is next ... with salt and water, made blood ... quenched in clean water, scoured ... sand and dried. The halves, ... been cramped, are brought together and wired fast, the seam is ... and brazed, the work being ... the traveler chain from overhead ... When the seams are ... cleaned off and the work ... clean, it is put in shape and ... on a cod. The seam is worked down and the piece planished ... to smooth and harden it. The mandrel Fig. ... a piece of cast iron or steel ... 7 inches in diameter, having a ... inch square hole in the center, so that it will slide on a square bar, the four sides of which are planed, turned or cast from a ... so they are segments of four circles ... to 20 inches in diameter to suit the different size pipes or cylinders. The mandrel is 3 feet in length. It is necessary to ... several of these mandrels of different sizes and length to suit different work.

Committees and Subjects for Investigation at the Next Meeting of the National R. R. Blacksmiths' Association.

Furnaces and Fuel—H. Williams, Ludlow, Ky. Ed. Carlson, Pullman, Ill., Frank Peck, Toledo, Ohio, J. E. Mack, Chillicothe, Ohio, A. A. Rice, Elkhart, Ind., A. L. Woodworth, Lima, Ohio, R. A. Mould, Gallion, Ohio.

Electric Welding—James Walker, Aurora, Ill., Frank Peck, Toledo, Ohio, A. L. Woodworth, Lima, Ohio, Ed. Tutberg, Chicago, Ill., A. D. Wilkins, Pittsburg, Pa., Wm. Henderson, Tacoma, Wash.

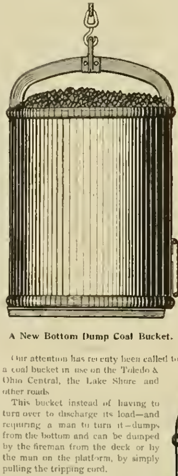
Hydraulic Forging and Bending Machines, Expenses of Dies, etc.—Papers to be offered by the following Committee—Henry Hinkens, St. Paul, Minn., Harry Jefferies, Pittsburg, Pa., Joseph Hughes, Bloomington, Ill., Ed. Carlson, Pullman, Ill., S. Uren, Sacramento, Cal., M. F. Foster, New Albany, Ind.

Axles and Best Method of Preparing Scrap for, and Manufacturing—W. W. McLelland, Denver, Colo., Ed. Carlson, Pullman, Ill., A. Younger, Sacramento, Cal., J. C. Hempsted, Pittsburg, Pa., Thomas Boyd, Peoria, Ill., D. T. Hughes, Frankford, Ind., John Hanihan, Springfield, Ohio.

Proper Material for and Best Methods of Making Side Rods, Crank Pins and Motion Work in General—Harry Jefferies, Pittsburg, Pa., John Buckley, Chicago, Ill., J. C. Stewart, Brainerd, Minn., Joseph Hughes, Bloomington, Ill., Henry Hinkens, St. Paul, Minn., Wm. Young, Springfield, Ill., W. J. Barrett, Lima, Ohio.

Springs—W. W. McLelland, Denver, Colo., Henry Thompson, Kaukauna, Wis., Thomas Weal, McComb, Miss., Sam Harris, Davenport, Iowa, A. D. Wilkins, Pittsburg, Pa., Joseph Northend, Meadville, Pa.

Welding, Best Methods and Best Results—S. Uren, Sacramento, Cal., James Walker, Aurora, Ill., Wm. Alexander, Milwaukee, Wis., Ed. Tutberg, Chicago, Ill., Thomas Daltrey, Huntington, Ind., Horace Penticost, St. Paul, Minn., Wm. Priest, Pullman, Ill.



A New Bottom Dump Coal Bucket.

Our attention has recently been called to a coal bucket in use on the Toledo & Ohio Central, the Lake Shore and other roads.

This bucket instead of having to turn over to discharge its load—and requiring a man to turn it—dumps from the bottom and can be dumped by the fireman from the deck or by the man on the platform, by simply pulling the tripping cord.

The illustrations on this page show the bucket full of coal and also partially emptied.

The bottom is hinged nearly in the center and there is a false bottom on an incline from the short side to the hinge, under this the short end, back of the hinge of the movable bottom, swings up.

The locking device is a simple lever that engages the bottom when level, to this is attached another lever that forces it to the unlock position.

With this bucket it is possible to put the coal just where you want it, the bucket can be made stronger with less weight of material and there is no danger of hurting men as is often done by the turn-over bucket. It is manufactured by the Excelsior Iron Works Company, Cleveland, O.

Cartoons Before the Days of "Puck."

"Mebby none of you fellers was born'd when the old engine 'Novelty' was revolutionizing the world on the Reading, away back in the forties," remarked the old-timer, as he slowly filled his pipe out of the president's pouch.

"The 'Novelty' was got up by Leroy Kirk, the master mechanic, and G. A. Nicholls, the superintendent, she had her engine separate from the boiler, the engine was very light and ran ahead of the boiler, the steam-pipe from one to the other being flexible. The engine was put to hauling coal, she was a queer scrap, and had to have two engineers and two firemen.

"The first men to run her were Seth Ham and Barney Butz, although Dave Clark, that's now master mechanic of the L. V., at Hazelton, Pa., run her afterwards.

"Ham had a purty good notion of his importance and 'allus referred to the other runners as 'them common engineers'—a'course this made him popular with the boys.

"Well, one morning there was great excitement in the Palo Alto House—where we all stopped—because of a cartoon picture of the 'Novelty' that was drew in the white sand on the floor. This here picture took off the new engine and her crew to a single allspice.

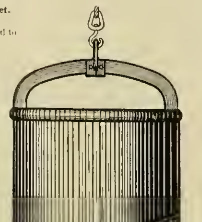
"Representin' the engine was one of them animals as used to chat with Mr. Balaam—a jackass. On his neck sat Seth Ham, with a hand on each ear, representin' startin' bars. Behind the jack was a elephant, representin' of the boiler, with his trunk a disappearin' into the jack in the neighborhood of the tail—representin' of the flexible steam-pipe. On the top of the elephant, with one of them ar Mahout's books, sat Barney Butz, big as life. Behind the elephant was a regular tender, with George Curtis and Bill Schrier—the two firemen—shovelin' coal into the elephant.

"Say! mebby you fellers think Seth wan't mad. Why, man, he wanted to run the engine to Reddin' light to report the matter to Kirk and Nicholls. The boys made so much fun of him and the cartoon that he quit, and, well, nobody never told who was the artist—'cause they didn't know."

Evans Wanted to Build Railroads 100 Years ago.

The probability that vehicles driven by steam would be the future means of transportation on land was very well foreseen twenty years before last century closed, by Oliver Evans, of Philadelphia, the inventor of the high-pressure steam engine. As early as 1786 he petitioned the Legislature of Pennsylvania for the exclusive right to use his inventions for road wagons to be propelled by steam. The word locomotive had not then come into use. This privilege was denied, but the Maryland Legislature granted the right for fourteen years. There appeared at one time good prospects of Evans obtaining the necessary financial support to apply his steam engine to the propulsion of boats and road wagons, but some cautious capitalists of that day determined to have B. H. Latrobe, an accomplished architect and engineer, report upon the schemes that Evans was advocating. Latrobe reported strongly against the steam engine, saying that the inventor was a visionary. This report ruined Evans's career, and deprived America of the benefits of the steam engine in transportation for two generations longer.

By a curious irony of fate, the son of this same Latrobe performed important engineering services in building the Baltimore & Ohio, the first railroad in this country where a steam engine was used successfully.



A Reformer Loose on Railroads.

An intensely funny story was written by Mark Twain for the December number of the *Cosmopolitan*. It is called, "Traveling with a Reformer," and relates principally to small abuses encountered by railroad travelers.

The modern Don Quixote whom Mark Twain brings into existence attacks abuses in a highly practical fashion, moral suasion and diplomacy being his favorite material of war. His mission was to root out all forms of rudeness and petty imposition, and to do it in a fashion that would reform the offender. In dealing with rude brakemen, saucy conductors, and others, his power is in being closely related to the president of the company. His stronghold is being brother-in-law of the president or general manager. His brother-in-law would make a big army. After starting out, their first adventure is with the supercilious telegraph operator, who tries to snub the public. After being snubbed when he tries to send a message, the reformer writes a telegram to the president of the Western Union, inviting that personage to come and dine with him that he may explain how business is conducted in one of the offices. Of course, the clerk collapses. He is forgiven and the lesson is left behind.

The reformer, who is an army Major, and his friend enter a street car late at night and three villainous roughs come in who make vile remarks, and make a disagreeable time for conductor and the women and children in the car. The reformer is troubled, and takes in the situation for a minute, then he exclaims, "Conductor, put off these swine, and I will help you." The hogs make a rush at the reformer, but he hits each with a blow like a trip hammer and kicks them off the car. This was called an emergency case, where a fist is the best persuader.

The reformers go to Boston over the Consolidated roads and the various trainmen get squeezed into politeness through fear of the president's brother-in-law. The great fun comes when the two go to Chicago. While traveling on Sunday they see the parlor car conductor stop a game of cards, and the Major volunteers to join the game, that he may vanquish the conductor and demonstrate that a railroad company is not authorized to stop card playing on any day of the week. The conductor comes and saying that card playing on Sunday is against the rules, orders the game stopped immediately.

"Nothing is gained by hurry," says the Major. "Who authorized the company to issue such an order?"

"My dear sir, that is a matter of no consequence to me, and—"

"But you forget that you are not the only person concerned. It may be a matter of consequence to me. I cannot violate a legal requirement of my country without dishonoring myself, I cannot allow any man or corporation to hinder my liberties with illegal rules—a thing which railway companies are always trying to do—without dishonoring my citizenship. So I come back to that question, by whose authority has the company issued this order?"

The argument proceeds at great length, and the conductor is greatly embarrassed, t he cannot produce any legal warrant for the order to stop card-playing, so he lets the game proceed, but is dreadfully worried. The train conductor comes round, and was going to put a peremptory stop to the game, but the sleeping car conductor took him aside and explained how matters stood, and then no interference was offered.

When the party starts to return from Chicago, a sleeping car in which they have engaged a stateroom is not on the train, and a section is offered in another car. The Major refuses the section and demands his stateroom.

"It's the best we can do," explains the conductor, "we can't do impossibilities. You will take the section or go without. A mistake has been made and can't be rectified at this late hour. It's a thing that happens now and then, and there is nothing for it but to put up with it, and make the best of it. Other people do."

"Ah! that's just it, you see. If they had stuck to their rights and enforced them you wouldn't be trying to trample me under foot. It's my duty to protect the next man from this imposition. So I must have my car. Otherwise I will wait in Chicago and sue the company for violating its contract."

"Sue the company for a thing like [illegible]"

"Certainly."

"Do you really mean that?"

"Indeed, I do."

The conductor looked the Major over wonderingly and then said:

"It beats me—it's brand new. I've never struck the mate of it before. But I swear I think you'd do it. Look here, I'll send for the station master."

When the station master came he was annoyed at the trouble raised—not at the cause of the trouble—but he had not long tackled the Major, when he decided to find a stateroom for the party.

When they were in the dining car the Major asked for broiled chicken, and the waiter said: "It's not on the bill of fare."

"That gentleman yonder," said the Major, "is eating a broiled chicken."

"Yes; but that is different. He is one of the superintendents of the road."

"Then all the more must I have broiled chicken. I do not like these discriminations. Please hurry. Bring me a broiled chicken."

The waiter brought the steward, who explained in a low and polite voice that the thing was impossible, it was against the rule, and the rule was rigid.

"Very well, then, you must either apply it impartially or break it impartially. You must take that gentleman's chicken away from him or bring me one."

The steward was puzzled, and did not quite know what to do. He began an incoherent argument, but the conductor came along just then, and asked what the difficulty was. The steward explained that here was a gentleman who was insisting on having a chicken when it was dead against the rule and not in the bill. The conductor said:

"Stick by your rules. You can't have any option. Wait a moment, is this the gentleman?" Then he laughed and said: "Never mind your rules. It's my advice, and sound, give him anything he wants. Don't get him started on his rights. Give him whatever he asks for, and if you haven't got it, stop the train and get it."

The Major ate the chicken, but said he did it from a sense of duty and to establish a principle, for he did not like chicken.

Patents have recently been granted to Mr. George W. Smillie of Newark, N. J., for improvements in car couplers. They are all of a highly practical character and relate to appliances intended to open the knuckle without going between the cars.

The Association of Railway Air-Brake Men will hold their next meeting at Columbus, Ohio, on the second Tuesday in April, 1894.

Origin of Standard Measures of Length.

BY JOHN H. COOPER

In reference to the origin of the measures of length, the literature of the subject is found to be quite voluminous, but the gist of it may be given in few words, which are here presented. For a first broad statement—they are derived from parts of the human body.

"Their values, roughly estimated, as well as their names, establish this beyond a doubt. The foot, the digit, the palm, the span, the cubit, the nail, the arm, etc., are in all languages derived from the same source, and in the popular view of measurement, they do not considerably differ in length. In former times, when authenticated measures were not so easily to be obtained, the hands, arms and feet were much more frequently used than they are at present.

"Taking these measures from a well-proportioned man, the fathom is reckoned to equal his height, the girth, or the pace ½ his height, the cubit, or distance from the elbow to the end of the extended middle finger ¼, the foot $\frac{1}{6}$, the span $\frac{1}{8}$; and the breadth of the palm, $\frac{1}{24}$.

"The actual employment of dimensions of the human body for the purpose of determining the unit of the length is not, as one might be inclined to think, a matter of a very remote past, in proof of which I will quote a book on surveying, published in Germany by Jakob Koebel, about 340 years ago. In this book the author gives the following instruction (accompanied by a wood cut, which is reproduced here), as to how the length of a foot is to be found.

"'To find the length of a rood in the right and lawful way, and according to scientific usage, you shall do as follows. Stand at the door of a church on a Sunday and bid sixteen men to stop, tall ones and small ones, as they happen to pass out when the service is finished, then make them put their left feet one behind the other, and the length thus obtained shall be a right and lawful rood to measure and survey the land with, and the sixteenth part of it shall be a right and lawful foot.'" (See E. A. Geiseler's lecture before the Franklin Institute, February 7, 1888.)

From *Nature Series*, "Weighing and Measuring," H. W. Chisholm says: "The existing imperial yard is so nearly identical in length with the old standard yards of Henry VII and Queen Elizabeth that it exceeds them by little more than a hundredth part of an inch—a difference frequently found in foot-rules now commonly used. There can also be but little doubt that our imperial yard is substantially the same length as the old Saxon yard."

We have no further direct trace to its origin.

But the English yard is so nearly the same length as double the natural cubit of the Egyptians and Hebrews, and the English foot is so nearly identical with the ancient foot—two-thirds of this cubit—that the origin of these two English units of length may not improbably be traced to these two earliest standard units. We know that the double cubit was used in ancient times as a measure of length. An old Egyptian double royal cubit found in the ruins at Karnac may be seen in the British Museum. We know also that a measure very nearly equal to two natural cubits was used by the Romans under the name of *ulna*, or ell. The *ulna* is mentioned by Pliny when describing the measurement of the girth of a tree, as half the length of the extended arms of a man. It may thus be fairly assumed that the measure of the double natural cubit, or three feet, under the name of ell or yard, came into use in old times as a very convenient measuring unit, and found its way into England as the standard unit of length.

With such an array of historical precedent can any objection be reasonably raised against the physiological data adduced in support of my new unit of measure, based as it is upon the needs of the eye and hand, as the units of the ages were derived from convenient parts of the human body?

That is to say: 1st. Make the least

ESTABLISHING THE F[illegible]

division on the scale of a width equal to the smallest visible space which can be transferred from the scale to the work by the unaided eye. 2d. Take 100 of these last spaces for the inch, which I have shown in a previous article to be equal to 1½ standard inches, and 3d. Make the foot of ten of these new inches—which would make the new foot 15 standard inches long—the two-foot rule, so universally used because of its convenience, would then be 30 inches long.

I close this presentation of measures—their origin and their use—by an English view of the subject from the pen of Sir Edmund Becket, Bart., President of the British Horological Institute.

"The length of a seconds pendulum so nearly resembles the French metre of 39.371 inches, that some persons may fancy that that most ridiculous and mischievous revolutionary measure had an origin even as rational as being the length of a seconds pendulum in some latitude. But it has not. It was intended to be the 40 millionth part of a meridian of the earth—about as rational a standard as if we enacted that the yard should be the 420 millionth of the mean distance of the moon, which it is, very nearly, and astronomers know the moon's distance within a less fraction than the difference of the metre from what it pretends to be, but is not.

"Yet there are people who want to force on all the world this absurd, inconvenient and useless measure, invented by a nation whose language is declining over all the world; while the English language, with that standard of measures which every man carries in his arms, his legs, and in his head, is spreading over all the world, so that it will soon be the only universal language to be found everywhere, if it is not so already. Doctrinaires of this kind may cram penny-school girls with French metres and centimetres, and kilograms; but our yard grew and will remain as the natural standard of length until the stature of the human race alters. For it is the length of a good stride of a man of what is generally considered the best height, and that height is two such lengths, and so is the stretch of his arms, and a yard is the natural length of his walking-stick.

"A metre would be the yard of a nation of giants. With the yard, too, goes the equally natural and still older measure of a foot, which all nations had, with such small variations as would occur in times when they had no scientific provisions for preserving exact standards.

"Some great authorities believe inches to have been the oldest measure of all, and the Egyptian cubit, which was unquestionably used in building the Pyramids, from the many simple multiples of it which occur there, confirmed by the discovery of one accidentally built up in a wall at Thebes, was probably twenty of their inches, being a little more than twenty of ours; and the 'sacred cubit' of the Jews was twenty-five, according to Sir Isaac Newton."

Night Schools Needed.

In spite of the extremely depressed condition of the industrial establishments in New York City, the evening classes, that are conducted for the education of workmen and others, have opened with the prospects of a highly successful season. New York City is remarkably well provided with evening schools, where artisans may receive instruction concerning the scientific phases of their business. The Cooper Institute is at the head of the organizations which provide facilities for enabling men or women, engaged all day in the shop or the factory, to acquire a technical education by attending evening classes. It is a sort of college, with the classes held at night. Students are given certificates for efficiency in the branches of study they pursue, and these certificates are highly valued by many owners of shops and factories when they are looking for foremen and others required to take charge of departments.

Besides this institute, there are many excellent night schools where good technical education is imparted. It is a great pity that every town in the Union, where a machine shop or a factory is to be found, is not provided with evening schools similar to those of New York. This is a matter in which America is away behind every other country having a population engaged in manufacturing pursuits. We are so intensely independent in our habits that the education of the artisan class is left to the individuals. All over Europe the authorities of cities, where mechanics and railroad men of all classes reside, make it their business to provide the means of education for the men who have to follow work that requires acquired skill or special knowledge; but here the same class is left to work out its own salvation, or fall into the chasm of common, unskilled labor. This is wrong, and is a species of misgovernment.

A great deal has been done for the higher technical education in this country within the last thirty years, but remarkably little for the lower species of technical education, which is the need of the workman. There are hundreds of colleges where young men may acquire an excellent technical education, but they are away beyond the reach of the intelligent workingman who wishes to learn the fundamental principles of his business. The educated workman is the most useful and potentially important individual in our national family, and more effort should be made to give the hundreds who are hungering after this standing the means of reaching the condition they are striving for. There is not a town of any size in the country where young men are not laboring to learn the science of the business they are engaged in during the day. It may be a machinist trying to learn drawing and mechanical science, it may be a telegraph operator or linesman striving to acquire a knowledge of electricity, it may be an engineer or fireman anxious to find out the principles of combustion or of steam engineering, or it may be the cases of others in various lines of industry laboring to find out the technical part of their business. Men or women inspired with this noble ambition ought to be encouraged. Their road to learning ought to be made as easy as circumstances will permit.

The indications are that this country is going through an industrial crisis which will end in close competition to hold the home market for home producers. In the struggle that is coming, knowledge and skill will be on the side of the victors. This being the case, it seems a national duty to give the mechanics and workers in the shops and factories the opportunity to educate themselves in the science that will enable our own breadwinners to hold their own against all competitors.

A Strange Coincidence.

Sitting by a cozy fire the other day were a party of railway supply and newspaper men, and the conversation soon drifted to the subject of coincidences and peculiar happenings.

Mr S. G. Scarritt, the head of the great St Louis furniture and car-seat manufactory, put his feet on the fender and said:

"I don't know as I believe in anything mysterious at all, but there is something strange in what happens often in our lives. I'll tell you of an incident—coincidence, if you like—in my life.

"As you may know, the Scarritt furniture factories were established in St. Louis by my father in 1838. I was a young boy, away from home at school in 1849, when the entire plant burned down and father had to start at the bottom again. He wrote me quite fully about the fire, his plans for the future, etc., and was strong and hopeful throughout—the fire made a strong impression on me.

"I always kept my father's letters, and after I came home, they, with other personal papers, were kept in an old desk in my office.

"Years passed away, the war came and I spent three years in the saddle, the business grew, and we changed quarters and offices, but I kept my old desk with its time-worn documents—valueless except to me.

"We were established in a great building occupying half a block, built, as we believed fire-proof, but one morning in 1887, I came down to business to find everything in ashes—it was enough to take the heart and spirit out of almost any man.

"The firemen had been able to get out some of the furniture and papers from the office—there was the records and bills and letters of forty years' business there. The little that had been saved from the fire was across the street in an alley and in other buildings, but everything was in great disorder, and most of the papers valueless. Among the things saved was my old desk, empty and charred and broken—but still on deck.

"There was two feet of papers and books on the floor, and, stepping among the wreckage the first thing that caught my eye was a piece of blue writing paper, such as was used years and years ago. I picked it up, remarking to myself that here was undoubtedly an old-timer. The edges of the folded letter were charred so that it came apart in small pieces the size of the letter, and turning over the first leaf I read

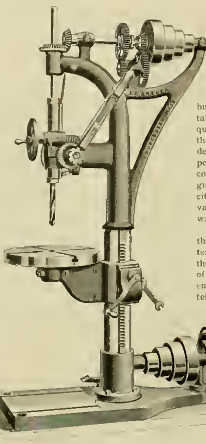
'The brave become bolder the darker the night.'

"It was in my father's hand, and the letter was the one telling me of the fire of '49—thirty-eight years before.

"That seemed to me, at that time, like a message from the clouds, an inspiration that could not have been so effective or complete from any other source, why, that scrap of paper, penned nearly forty years before by my father, when he was undergoing the same strain and anxiety that I was now undergoing, should turn up then and there with such words of encouragement will always be a mystery to me."

A New Drill Press.

The accompanying cut represents a new 21-inch stationary head, wheel and lever feed combined, upright drill, with back gears, recently placed on the market, by J. E. Snyder, of Worcester, Mass. This machine is made with or without the back gears. The back gears are quickly connected or disconnected by means of a lever descending parallel with the column. The table and arm can be adjusted to any desired height on the column by means of a crank in connection with worm and worm gear. The quick return to spindle is obtained by a hand wheel on the left side of drill. The rack, and also the pinion gear for feeding the spindle, are made from steel. The bevel gears and back gearing are all cut from solid stock. The arm which supports the table can be swung around the column, and heavy work can be done by bolting the same to the base, which is planed square with the column. The spindle is made from best steel, and the hole in same conforms to the Morse taper. On account of large cones and pulleys, this machine is capable of doing quite heavy work. This drill is thoroughly well made, and will be found a very handy tool for general machine-shop purposes.



Mr. Snyder makes a specialty of upright drills, and therefore excels in his line. One electrical plant have in use nearly one hundred of his drills in various sizes.

Danger of Defective Brake Mechanism.

The automatic air-brake cannot fail to work if it is in proper order. This fact has been persistently preached to railroad men, and the teaching has been well heeded as a whole, but occasionally we find on some railroads the brake mechanism so shamefully neglected that those in charge appear to court failure. It is still too common to find men in charge of railroad machinery who consider that they have performed their whole duty when they have applied brakes to locomotives and cars. A prevailing source of danger is neglecting to take up the slack of the brake gear. An engineer told the writer last month that he ran past the station one morning at his first stopping-place. Feeling certain that something was wrong, he went back to inspect the brakes, and found three cars out of the six with the brake piston up against the head. Men responsible for trains going out in this dangerous condition ought to be punished.

There are other defects to be found which are almost as dangerous. A writer in the *Engineers' Journal* last month gives particulars of a curious cause of brake failure. A passenger train ran through a freight train on a crossing, and the engineer reported that he applied the brakes and that they failed to work. Here is the full story.

"As usual, the engineer was suspended and an investigation instituted. The brake was carefully examined on all the cars constituting the train, and nothing being found wrong the division superintendent decided that the blame lay with the engineer. It happened that the general superintendent was well acquainted with the engineer, and had so much confidence in the care and judgment of the man that he ordered a special investigation after it had been decided by the division authorities to saddle the engineer with the blame. A meeting of old engineers was called in the office of the general superintendent discuss the case. They were all anxious to exonerate the man on the rack, but when they were taken separately and questioned about how they thought the accident could have happened, they invariably concluded that the engineer got a little excited and turned the valve lever the wrong way.

"This did not suit the general superintendent, and he placed the matter in the hands of the road foreman of engines, a smart, intelligent young man, noted for the thoroughness of his work and the persistency of his methods. This officer, after examining the brakes on all the cars and their connections thoroughly, turned his attention to the brake mechanism on the engine. Here he found that an old three-way valve was used as an engineer's valve, which had the stop so badly worn that after applying the brake full the handle would turn round a little more and release the brake. The engineer, seeing the danger ahead, had turned the lever round as far as it would go, with the result that he released the brake after applying it.

"The moral of this accident is that the brake mechanism should be maintained as nearly perfect as possible. It appears to point to the advantage of having the trainmen so drilled that they would pull open the conductor's valve when a call was made for brakes by the engineer."

Pioneer Improvers of the Lathe.

The best machine tools in the world are now made in the United States. For a few years after the manufacture of machine tools was commenced on this side of the Atlantic, there was a tendency to follow British models, but our mechanics soon fell into the habit of making improvements to suit themselves, and now American tools are imitated by all other makers. The first important improvement on the lathe was the invention of the slide-rest, by Henry Maudslay, of London. There is an impression that Maudslay perfected the engine lathe, but that is far from the truth. The first engine lathes brought to America were very clumsy, inconvenient affairs. The first of our mechanics to make his mark on this tool was Rufus Tyler, of Philadelphia. George Escoe Sellers, writing in the *American Machinist* some years ago about the development of the lathe, says

"It is hard for the machinist of the present day to realize that at comparatively so recent a time bed-post legs, spade handles, rolling-pins and the like, were turned on spring pole lathes operated by a foot treadle, one half of the time being lost in the backward motion of the piece being turned. It was not till two or three years previous to the opening of the Franklin Institute (1824) that the wooden grooved treadle wheel for catgut or raw-hide round belts gave place to the cast-iron wheel and flat belt. This innovation was made by Isaac Lukens.

"It was about the year 1822 that a Maudslay slide-rest lathe found its way to Philadelphia. It was taken hold of and greatly simplified by Rufus Tyler, who was at that time making small iron shear foot-lathes, he having adopted the steel mandrel, conical in its front bearing, running in hardened steel collars, and also the push pitman to the treadle instead of the ordinary hooks.

"Isaac Lukens was chiefly engaged in making town clocks, but found time to finish two or three small lathes a year. He also got up a simple form of slide rest. To cut the screws for it, he converted one of his little iron shear foot lathes into a very effective slide lathe, with gearing to cut screws of various pitches. The bed-plate of his slide rest was wrought iron forged with a drop stud or spindle that was turned to fit on the ordinary rest carrier, to take the place of the common rest. The face of this bedplate was 9 inches long by $3\frac{1}{2}$ inches wide, the cross-head having a travel of 5 inches and the tool-carrying block or head a traverse of $2\frac{1}{4}$ inches.

The United States contains a very large mileage of railroads, and the number of trains moving daily is almost beyond computation. It is natural that there should be a great many accidents among all the vast number of trains, but they are more numerous than they ought to be. Better mechanical provisions for operating and improved discipline would certainly reduce the accidents. An analysis of a report in the *Railroad Gazette* of accidents during the month of September shows us that there were accidents to 29 passenger trains and 111 freight trains, involving 76 deaths and injuries to 168 persons. Collisions were the most numerous, and caused the greatest loss of life and suffering. The accidents were spread over nearly the whole territory in the United States.

Those who are intimate with Mr. M. N. Forney are aware that he is an ardent believer in the use of a firebox which will transmit to the tubes of a boiler all the heat generated by the act of combustion. In the ordinary firebox, surrounded by water, a material portion of the heat generated is absorbed by the firebox sheets, which keeps the furnace temperature comparatively low. Mr. Forney proposes to line the firebox with fire-brick or other refractory material, and he has patented an arrangement of this kind. We will be very much interested in noting the measure of success in fuel saving attained by a firebox constructed according to Mr. Forney's patent.

Experiments on Locomotive Counter-balancing.

Professor Goss, of the Purdue University, La Fayette, Ind., has been experimenting with the counterbalancing of locomotives. As most of our readers are aware, the engineering school connected with that university has a Schenectady locomotive, which is secured on large revolving rollers, which enable those making experiments to run the engine at any required speed. This enables, the engineers in charge to make tests that are more conclusive and accurate than locomotive tests made on the road, where outward conditions are never constant.

In making tests to show the effect of the counterbalancing of the drivers, wires $\frac{1}{8}$-in. diameter and about as long as the circumference of the driving wheels were fed between the line of contact of the driver and carrying wheel. The ordinary weight of the engine flattens the wire to about $\frac{1}{16}$ inch. The action of the counterbalance weights flattens out the wire at the points where the resulting extra pressure comes.

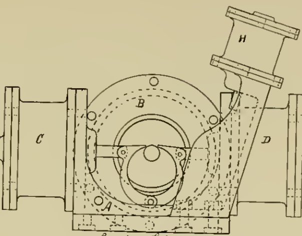
The *Railroad Gazette*, describing the experiments made, says:

"Speed of circumference of wheel sixty miles an hour or 88 ft. per second. Revolutions per minute about 320. Diameter of wire $\frac{3}{32}$ in. Drivers lift from the rail so as to give a short length of full sized wire before a speed of forty miles an hour is reached. The drivers lift when the counterbalance is up. Since the engine was received the counterbalance has been increased so that now the weight of the reciprocating parts is completely counterbalanced. The longitudinal oscillations of the engine known as "galloping" are very small and are caused by the angularity of the connecting rod which makes it impossible to counterbalance perfectly with a finite length of rod. The shorter the connecting rod with reference to the crank, the less is the possible perfection of the counterbalance.

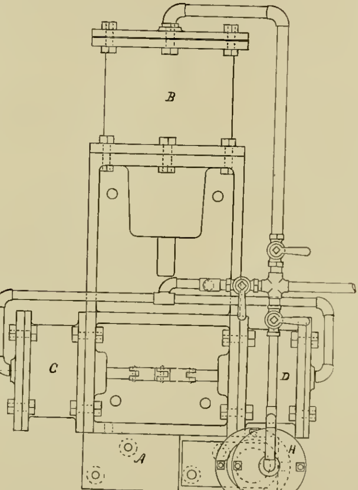
"At sixty miles an hour, the length of the full section of the wire is 30 in., corresponding to about 55 deg. of revolution. The exact height of the lift of the wheel cannot be measured with the present apparatus, but it is known that the wheel is $\frac{1}{32}$ in. from the rail at the beginning of the 30 in. and is going up rapidly, and reaches a distance of $\frac{3}{32}$ from the rail in its downward course at the end of 55 deg. The total lift may be as much as $\frac{1}{8}$ or $\frac{1}{4}$ in., probably not more, at a speed of sixty miles an hour.

"It is evident that the wheel travels upward less rapidly than it falls, as the distance measured on the wire from the full flattened part to the point of the commencement of the full section is greater than the distance during which the drop takes place. Apparently the wheel rises $\frac{1}{32}$ of an inch in 63 deg. and drops $\frac{3}{32}$ of an inch in 12½ deg. of revolution, thus showing that the fall of the wheel to the rail is more rapid than the rise from the rail. This is in accordance with the theory of action, for the reason that going up the wheel lifts against the force of gravity and the driving-spring, while coming down these forces act downward with the motion of the wheel.

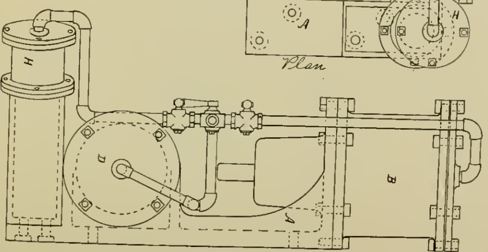
"The most important conclusion from these experiments is that under normal conditions the drivers lift from the rail, and probably this takes place in every-day practice where locomotives are run at forty miles an hour and upward. Other conclusions may be drawn from the results, but this is the principal and the safest one."



End Elevation



Plan



Side Elevation.

Accidental Discovery in Copper Refining.

The key that led to some of the most important inventions known to the arts has been discovered by accident. Another invention that is likely to prove of the highest value in this country has just been added to the list of accidental discoveries. Chemists in all parts of the world are constantly experimenting to find out new processes by which metals may be separated from the impurities present in the ores. So much work has been done in this line to separate copper from the ores that it is surprising that any possible method had been overlooked, yet a singular accident revealed something in the Baltimore Copper Works which is likely to bring into use a new refining process.

At the establishment referred to the reverberating furnaces are connected with a great chimney by means of long underground passages, called "culverts," in which more or less oxydized copper, as well as sulphides, arsenides and other compounds, is carried off in the form of dust and smoke. These are deposited in the culverts, and are subsequently collected to be worked over again. Amid an accumulation of such stuff, a few days ago, there were found iridescent, mosslike masses, which upon examination proved to be pure copper. How the transformation was effected was a mystery, until it was discovered that petroleum, which saturated the soil in the vicinity (having escaped from a neighboring refinery) had entered the culverts through a crevice. Under the influence of high heat it was volatilized, and the resulting gases had "reduced" the oxides and sulphides into pure metal.

Hose Fitting Apparatus.

The apparatus illustrated in the annexed engravings is in use in the Erie shops at Meadville, Pa., and is employed for applying the fittings to air-brake and heating-pipe hose. It was got out by Master Mechanic Smith and his assistants. The apparatus consists of an arrangement of cylinders and holders, which hold the hose and force into place the fittings. When a hose is laid down in the machine a grip grasps it and holds it steady, while the ram from a piston forces in the coupling casting. This is then released, and a clasp forces the band round the hose and holds it there until the bolt is tightened up. All the appliances for operating the apparatus are within easy reach of the man doing the work and every movement of his hand counts. With the aid of this invention one man can apply fittings to 250 hose in one day as compared to thirty-five finished hose when the work was done by hand.

The valve-stems of locomotive "982," N. Y. C. & H. R. R., were packed Dec. 5, 1892, with Vulcabeston concave and convex rings, were "set up" Dec. 6, 1892, and have not been touched since.

The engine has been in constant use on express train between New York and Albany, and has been run over 100,000 miles, the stems moving over 27,000,000 times in each direction, or about 22,000,000 feet (over 4,200 miles).

The packing rings seem to be as good as when put in, the rods are not worn or scratched and are perfectly smooth.

The machine requires general repairs and must go into the shop to be overhauled, otherwise the rings would be continued in use.

A rotary engine has been patented by Mr. James F. McElroy and assigned to the Consolidated Car Heating Co., Albany, N. Y. It is very ingeniously worked out, and is intended for use in connection with car heating.

The Intercepting-Valve.

The description and illustration of the valve motion of the Baxter compound locomotive, which appeared in the December number of Locomotive Engineering, deserve to be closely studied by those who are interested in the history of the compound locomotive. The mechanism displays great ingenuity in the designing of apparatus that would distribute the steam in a manner calculated to make a compound locomotive a success. We have seen the statement made that no two-cylinder compound locomotive worked successfully until Von Borries, in 1880, invented his intercepting-valve. Before the [illegible] of the two-cylinder locomotives [illegible] was said to be defective in starting power. When the high pressure crank was near the center there was [illegible] to start with because the low-pressure piston did not help until the exhaust steam was admitted from the high pressure cylinder.

Attempts were made to remedy this weakness by admitting steam to the receiver, but this was not an effectual remedy, because the live-steam pressure in the receiver acted as back pressure against the high-pressure piston. To prevent the live steam in the receiver from working against the high-pressure piston in starting the intercepting-valve was invented.

To Von Borries is generally given the credit of inventing the intercepting-valve, which is so designed that it closes the passage to the high-pressure piston at the moment when the engine is starting, thus preventing the live steam admitted to the receiver from flowing back through the exhaust port against the high-pressure piston. This was an important invention, but an examination of the drawings of the Baxter compound locomotive reveals the fact that it was used on that engine ten years before Von Borries' compound locomotive was built. This is an historical fact of the first importance, for it seems to be admitted by most engineers that no one thought of providing means to close the high-pressure exhaust port against the live steam from the receiver until Von Borries worked out the problem.

We understand that the builders of compound locomotives in this country who have used an intercepting-valve have paid royalty to Von Borries as the patentee of the device. We have no inclination to advise people to attempt avoiding to pay the just toll of royalty on inventions that have made plain the way to successful use of engineering appliances, but we think that the intercepting-valve idea belongs to the Baxter engine, and that later inventors are not entitled to royalty on it unless it be for later improvements. As the cylinders of the Baxter compound locomotive are still intact there would be no difficulty in proving that a practical intercepting-valve was used with them.

Locomotive Test.

Mr. F. C. Winby, proprietor and inventor of the locomotive "James Toleman" exhibited at the World's Fair, has been in the East trying to arrange a test of his engine with some of the other locomotives that were on exhibition. He is particularly anxious to try the powers of his engine against the New York Central's "999" but the company decline to go into any race or test. The Baldwin people say that they are quite willing to run their engines against the "James Toleman" on ordinary hard fast train service, and they are satisfied that they will not come out of the contest with anything to regret. This is not the kind of trial Mr. Winby wants, but it is probable that he will consent to it when a spectacular race cannot be arranged.

Not a few engineers who examined the "James Toleman" are anxious to see her tried in competition with an American locomotive of similar capacity. The service test would certainly be the most satisfactory, and we hope to see arrangements made to carry one out.

Doc Has Trouble.

By [illegible]

My friend Doc was up in the North Woods hunting deer last week. When he came back past our town, of course, he had to stop off and show me a couple of nice deer he had been lucky enough to get. After supper we got to talking engine as usual. Doc related some of his troubles after this fashion:

"When I was up north I saw something that took my eye. It was a check-valve in the train-pipe close to the driver-brake triple-valve set at 20 pounds, so you could not set the driver-brake till the train-brake was set tight, and then it would take hold. The engineer said all their engines were fixed that way and it worked bully, driver-brake shoes would last a year, engine didn't ride hard, wedges and boxes didn't get any shock. I says to him 'That would be a good thing on a dining car, wouldn't shake up the victuals when you make a fly stop.' 'Not much,' says he, 'don't want to have them on cars, it wouldn't be safe there, you couldn't stop at stations if only part of the cars had their brakes set.' 'Well' says I, 'it ain't any harder work to stop a car with no brake working on it than an engine. It don't weigh any more.' 'Oh, yes,' says he, 'you don't look at it right. See all the reserve power you have for an emergency when you want it. You can draw forty pounds off your gauge and your driver-brake is set tight, too.' 'That is a fact,' says I. We didn't talk any more about it, for I see he knew he was right. But just the same I want all my brakes to set alike, not part of them full on and part of them not at all. Give me a good working brake on every wheel, and you don't meet half as many emergencies, because you don't run by stations, and when you see a red light looming up close in a fog, you know all of them will work at once. I used to cut out my driver and tender-brake when I had a good working train, and didn't tumble to the fact that it wasn't safe, till one day when a flat car fouled the main line, the link broke in the tender when the brake on the cars took hold. Before I could tip her over and get stopped, my steam-chest was under the car that did not clear. I got ten days for that mishap. You can bet when I got to work again the brake on engine was not cut out any more. Likely that engineer thinks he is saving his engine by making the train do all the braking, if that is a fact, what is the use of having any brake on the engine.

"Now, we are talking about air-brake. My fireman, Billy Brown, is always talking air-brake with the boys, but he never says much to me. Some time ago we had hold of a fast stock train ready to pull out. We had tried the air and waited for the yardmaster to figure out about putting another car on the train, when we pulled down to the main line switch. I set the brake pretty tight. Before it had time to take hold on the train we got a signal to come ahead. I let it off, and Billy sang out, 'Hold on, your air ain't working right.' 'How do you tell?' says I. 'Cause,' says he, 'you hear a long blow of air from train line exhaust when you set the brake on a train, and a short one when you have just the engine and tender. Didn't you hear a blow from train-line exhaust when you let the brake off? That's a good sign you have only your engine working air. It don't do it with a train.' I squalled for brakes, we stopped; sure enough, they had cut out air off behind the tender to take on the other car, and when we went without it they didn't cut us in again. When the head man got up on the engine, Billy says to him, 'Another case of tramp turning the air cock.'

"The next crack Billy got at me was when we broke in two between the two air cars we had on the head end of train, leaving one car of air with my engine and one car of air with eighteen loads. I pulled her wide open to keep out of the way of the hind end of train, but the brakes stalled me when I got about three car lengths away. When the hind end run down and struck me it broke two drawheads. Billy was laughing at me, and says, 'That was your own fault, you will learn something about the air-brake by-and-by if you have enough of this kind of practice.' 'Sonny,' says I, 'I had this brake business down fine ten years ago before you was big enough to railroad any.' Says he, 'you learned most all you know about it fifteen years ago, and ain't learned any more since. Next time you break in two this way, shut her right off quick, and the brake will hold you so you won't get over ten feet away from your train, and you won't get hit hard enough to break anything. The idea of pulling

Old Ten-Wheeler "A. Lincoln," D., L. & W. Ry.

away from a moving train with not enough brakes on it to stop it, when you ought to know your brake will stall you and let the hind end run into you. A man that has learned anything about the brake lately ought to think of that. An old engineer's first impulse is to get away from the hind end and keep away, but you can't do it if the brake is set on you.' You bet I was hot to have him call me down that way, but said nothing—was too mad.

That is where the young fellows are getting ahead of us on the brake They learn it as it works now, and don't have the old-fashioned straight air mixed up with it Clint, you have jacked me up lots of times for being an old fogy, but we are getting there just the same. I skidded a pair of wheels on my tender last summer when they commenced to slide, dropped some sand, but they slid just the same and made a flat spot on the No. 1 wheels. If I could let the brake off so the wheels would begin rolling a little they wouldn't get flattened so much, but my tender brake never lets off till the last thing What is the reason for that, and why did only one pair of wheels get flat?

Another thing puzzles me. I was second engine on a double header. There is no cut-out cock in the train-pipe near my brake-valve, so I had to carry my brake on lap to let the head engine work the brakes. Every time he let off the brakes the air would blow out of my train-pipe exhaust ... Billy said it was because he carried more air than I did. So he made a plug, and put it in the exhaust elbow. She went all right after that—my brake-valve was O K., not a leak in it anywhere. What made it do that? I see our traveling engineer, Ike, in a sweat the other day. My engine don't exhaust square, he was looking her over to see what the trouble was, and could not find it for a long time. She had a light exhaust and a heavy one. The machinist run her valves over and said they were set square, so they took out the exhaust-pipe; thought that was stopped up on one side, found it all clear; tried the tumbling-shaft arms, they were O K—and gave it up. Come to find out the steam-ports on one side were 1¼ inch wide, on the other 1⅛ inch. Both valves were same length, the travel the same, but the valve on the wide port had ¾-inch lap, while the other one had ⅞-inch. Of course, the wide port cut off last and used the most steam. I chuckled to myself when I see him looking around for it, for all the rest of them had give it up. I did not know what ailed her, but I heard one of the machinists say something about wide ports on one side, so I told Ike. He measured the tram marks on her valve-stems, and, sure enough, her lead was the same on both sides, but the *cut-off was way out* of being the same."

My garrulous friend, Doc, is not very far away from the old rut he has been walking in for so many years. He acknowledges that his fireman, by inquiry and study, together with close observation, has caught on to a good many facts about the working of the air-brake that Doc has not got down very fine. To tell the honest truth, Doc respects Billy for what he knows, and would like to know all these things himself, but it is a good deal of trouble to learn them and unlearn the old notions of twenty years ago. I had a long talk with him. The next day we went down to the shop, put a gauge on the tender auxiliary reservoir and one on the driver-brake reservoir, and showed him that one 8-inch cylinder full of air taken out of a large reservoir to set the brake, did not reduce the pressure as much as two driver-brake cylinders did the small driver-brake reservoir by 8 pounds, and the train-pipe pressure had to be raised 8 pounds after the driver-brake let off to let off his tender brake. Then we went up on a double header just ready to pull out, and tried the other experiment by carrying more air on the head engine than on the second engine, with second brake-valve on lap. I won't say just how this experiment turned out—try it yourself—but Doc was satisfied he knew more about it. He says he gets along just as well, makes just as much money, and has as good a run as the fellows who are worrying themselves to find out something. Maybe so

Gail Hamilton says that she always considers paying railroad fare a great waste of money, for one needs all the money to buy things at the end of the journey. Gail has a very low opinion of the Inter-state Commerce Law which gives railroad managers an excuse for refusing passes

A Wild Spot in the Selkirks, Canadian Pacific Railway. Train in Upper Right Corner.

"Things are looking pretty blue are they not?" asked a reporter of a southwestern paper in search of locals. "Well," answered the machinist questioned, "times might be worse if our bosses would try a little harder They have cut off all passes, they forbid us to smoke in the shop, and the pay-car has not been round for three months. The shop is damp enough to raise cranberries on the floor, the roof leaks and the place is badly heated. But they let us work here without charging anything. Times might be worse."

We have received from Mr R. F. Brown, mechanical superintendent of the Intercolonial Railway, a blue print of a locomotive designed by him for the Canadian Pacific nine years ago. In this engine the style of low running-board seen on the compound locomotive built by the Pennsylvania Railroad at Altoona is employed. At first glance this style of running-board looks more convenient than those in general use. The men handling the engines, however, object to it on the ground that the low running-board prevents them from seeing the rods, pins and crosshead when running, and that it makes the motion and axle-boxes more difficult to reach.

During the month of October last the 498 road locomotives on the Santa Fé made 3,865 as an average mileage. The total cost of operating the locomotives was 19.69 cents per mile, a remarkably low figure when we consider the country traversed by the road, the bad feed water used, and the high cost of coal in some districts. The expense is made up of the items 0.14 cent for stores, 0.2 for oil and waste, 7.42 for fuel, 6.77 for engineers and firemen, 1.23 for other attendants and 3.93 cents for repairs The total miles run was 2,273,337.

A Lock-Up Angle-Cock.

The illustration herewith shows very plainly the lock-up plug and key used on an ordinary angle-cock to prevent its being

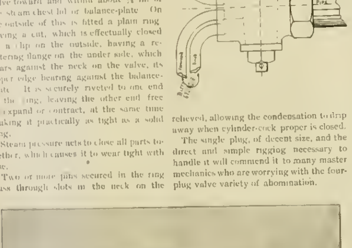
turned accidentally or otherwise. This cock is the invention of Mr G M Tower, foreman of the locomotive repair shops of the Fitchburg shops, at Fitchburg, Mass

A New Balanced Valve.

The valve balance illustrated on this page is so plain as to scarcely need description. It consists of the usual neck or cylinder extending from the back of the valve toward and within about ⅛ in. of the steam chest lid or balance-plate On the outside of this is fitted a plain ring having a cut, which is effectually closed by a clip on the outside, having a re-entering flange on the under side, which bears against the neck on the valve, its upper edge bearing against the balance-plate It is securely riveted to one end of the ring, leaving the other end free to expand or contract, at the same time making it practically as tight as a solid ring.

Steam pressure acts to close all parts together, which causes it to wear tight with use.

Two or more pins secured in the ring pass through slots in the neck on the valve, and rest on the arms of a radial spring. This spring has a set screw in the center by which any degree of tension can be given to hold the ring up against the balance-plate. The screw point acts as a fulcrum, on which the whole oscillates freely, to conform to any irregularity



The clip can extend entirely around, forming a double ring like the one lying on the left side. In this case the pins pass loosely through holes in the inner ring and are secured in the outer one, which supports the former on its flange. It can be cut like the inner one, as shown, or not.

The rings can be supported by four spiral springs outside of the neck in place of radial spring shown, if preferred

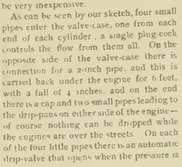
On the right side is shown a clip-ring turned up, with one clip cut out. Ten clips can be cut from one ring

The work is all plain lathe work, inexpensive in first cost and easily repaired. This, with its ability to stand hard usage, the inventor thinks makes it specially adapted for locomotives. It has been patented by Mr. E. P. Cowles, of New Decatur, Ala., a manufacturer of steam engines and tramroad locomotives.

A Simple Cylinder-Cock.

Mr. W. T. Thompson, master mechanic of the Kings County Elevated road, in Brooklyn, has recently put on his engines a very simple cylinder-cock rigging that seems to answer all requirements, and to be very inexpensive.

As can be seen by our sketch, four small pipes enter the valve-case, one from each end of each cylinder, a single plug-cock controls the flow from them all. On the opposite side of the valve-case there is connection for a 2-inch pipe, and this is carried back under the engine for 6 feet, with a fall of 4 inches, and on the end there is a cap and two small pipes leading to the drip-pans on either side of the engine—of course nothing can be dropped while the engines are over the streets On each of the four little pipes there is an automatic drip-valve that opens when the pressure is



relieved, allowing the condensation to drip away when cylinder-cock proper is closed.

The single plug, of decent size, and the direct and simple rigging necessary to handle it will commend it to many master mechanics who are worrying with the four-plug valve variety of abomination.

There has been on exhibition at the Windsor Hotel, New York, the Tower car coupler, which has attracted much attention from railroad men. This coupler is of the M. C B pattern, and bears the traces of having been designed by a mechanic who understood how to provide against the complex shocks and strains to which a car coupler is subjected. It has a very simple and substantial locking device which is not likely to get out of order readily, and part of the locking mechanism is employed to throw open the knuckle when uncoupling is done. The knuckle is a simple form that can be easily made strong, and it is so designed that in pulling or buffing the shock comes upon the coupler body and not upon the pivot pin.

The Cleveland Twist Drill Company have closed up their factory for the holidays and to make such general repairs as are necessary, also to take inventory of stock Until this brief shutting down took place, they were running full time, but with a reduced number of hands. They have a full stock of goods on hand and are in a position to fill orders promptly.

? A. What You Want to Know. ? A.

Don't ask questions that simply require a little figuring to determine; make each question separate. No notice taken of anonymous questions.

(1) Inquirer, Water Valley, Miss., asks

Has the mass of an article any influence on the extent of expansion and contraction? That is, will a sheet ⅛ inch thick expand and contract as much as a sheet ¼ inch thick? *A.*—There will be no difference if they are the same length.

(2) W S, Fort Howard, Wis, asks

1. Is there an automatic vacuum brake patented in the United States, and if so, where can I get a description of it? *A*—Yes. It is an English patent—none made or used in U. S 2 Is a non-lifting injector as efficient a boiler feeder as a lifting injector? *A.*—Yes.

(3) H. A. C., Los Angeles, Cal., asks

Are locomotives direct or indirect valve-motion engines, and where is the difference? *A.*—An indirect valve motion has a rocker—the valve goes back while the eccentric blade goes ahead Direct valve gear, the valve travels with the eccentric—the stem is connected directly to the link. Both kinds are used, but most locomotives in America have indirect valve motion.

(4) Foreman, St. Louis, writes

Is there any rule for establishing the proper speed of grindstones? Our grindstones were run so slow that lots of time was wasted at them. I have speeded them up, and some of the men say that they run dangerously fast. They certainly throw the water badly. *A.*—The proper peripheral speed for a grindstone for tool work is about 250 feet per minute. If it makes the water fly off it is running too fast.

(5) A. M S., Indianapolis, Ind., says.

I have several small iron and steel articles that I would like to cover with a thin film of copper to keep them from rusting. How can it be done? *A.*—Clean the surface of the article thoroughly by dipping in a mixture of sulphuric acid and water. Then wash off the acid thoroughly and immerse the articles in a solution of sulphate of copper, leaving them long enough for the required thickness of coating to be formed.

(6) C A. R., St. Thomas, Ont, says

What is the use of making the valve of the low-pressure cylinder of a compound so that it will cut off before the end of the stroke? *A.*—A cut-off is used in the low-pressure cylinder because it results in economy of steam. Many attempts have been made to use the steam in the low-pressure, through the full stroke, but the arrangement never worked satisfactorily. To explain the reputed causes of this would require more space than we can devote to this department.

(7) Wm. O. D., Conneaut, O, asks

What is the exact number of pounds of air we get in brake-cylinder from train line in emergency application, train line and auxiliaries charged to 70 pounds when application was made? *A.*—It all depends on size of cylinder and travel of piston—in other words, in the *volume* the air has to expand into. The best way to state it would be, the amount of pressure taken out of train-pipe, in an emergency application, by the quick-action valve = we do not know exactly, but it is a very small amount.

(8) C. A G., Saginaw, Mich., asks

1. Why does a high stack have more draft than a low one? *A*—The less the height of a stack the greater the intensity of heat required to create draft. Intensity of heat is as the square root of their height. 2. Where and how can I get a copy of the Westinghouse air-brake instruction book or catalogue. *A*—Write to W. A. B. Co., Wilmerding, Pa. 3. How is steam admitted to low-pressure cylinder on Baldwin four-cylinder compound. *A*—Through the piston-valve that admits live steam to the high-pressure cylinder.

(9) R Young, Boston, writes

Suppose a locomotive with a boiler pressure of 140 pounds is pulling a train regularly, and can do most of the work when cutting off at ¼ stroke and slightly throttled. Would there be any gain by increasing the boiler pressure to 180 pounds? *A.*—We think there would be loss instead of gain. The engine would have to be throttled more, and there would be loss from slipping, without any gain in steam expansion. The throttled steam would be a little superheated but that gain would not be enough to offset the losses

(10) J M. Atkinson, Kamloops, B. C, writes

1. What is the chief cause and remedies for air-pumps running hot in air-cylinder, also air-pumps knocking? *A.*—Read "Diseases of the Air-Brake System, their Causes, Symptoms and Cure," in this paper. 2. What is the best preparation and mode of using same for case hardening? *A.*—Case hardening is produced by heating articles to a cherry red in a close vessel, in contact with carbonaceous material, and then plunging into cold water. Bones, leather, hoofs, horns, etc., are usually used for this purpose—being first burned to a crisp and pulverized. This process converts the surface of iron into steel by cementation. It hardens the surface but reduces the strength about 10 per cent.

(11) J. B., Syracuse, N. Y., asks:

Is it possible or likely that a man who is in good health and has passed a rigid examination for color blindness would become so color-blind two years afterwards that the company decided that he was not safe to be upon a locomotive? *A*—It may be possible for this to happen, but it is very improbable. There is one form of color blindness, however, which has been fatal to not a few railroad men that may develop in the length of time stated. It is almost certain to be rapidly developed in a man who takes an unduly active interest in labor organizations or makes himself obnoxious to men in authority. We have known a variety of cases where men of this kind suddenly became color blind and at once lost sight of their jobs It is surprising how much lack of color a company's surgeon can see in the eye of a man who is considered objectionable.

(12) Arthur Graham, Adel, Ia, asks

1 Where can I obtain a book treating of the construction and operation of the English locomotive? *A.*—Ask for Reynolds' "Locomotive Engine Driving," Engineering Literature Co., East Orange, N. J. 2 What is meant by "draught of water inches" of a chimney? *A*—A U-shaped glass tube, partially filled with water, has one end open to the atmosphere and the other inside the chimney. The partial vacuum in the chimney will let the air force the water down in the outside tube, and this is read in inches—it tells the difference in air-pressure inside and outside the chimney 3. What is meant by a "24-inch vacuum" in a condenser? *A*—If a U-shaped tube partially filled with mercury has one end open to the air and the other to a practically perfect vacuum, the pressure of the air will move the column of mercury down, practically 29 inches. this 29 inches is scaled off to read degrees of vacuum; 24 inches in a condenser would mean that 24/29 of a practically perfect vacuum. 4. Does the vacuum gauge register in inches or pounds? *A.*—Inches.

(13) C. Jordao, Chicago, writes:

I was at a meeting last evening, where a speaker made the statement that railroad history was considered of so little consequence in its infancy that there are already doubts concerning when and where the first locomotive was introduced west of the Alleghanies. Can you give any facts about this? *A.*—Railroad history has been sadly neglected, but we think that a little investigation would easily reveal when and where the first locomotive was put to work west of the mountains. We do not have accurate information at hand, but we have seen the statement made somewhere that in 1834 a Hinkley engine was transported by several different methods from Boston to Johnstown, Pa., to be used on the Alleghany Portage Railroad. The engine was taken in the fall of the year to Pittsburg, and was used by Wade, Totten & Co. as a model, from which they built the first two locomotives constructed west of the mountains. About the time these engines were built the Mad River & Lake Erie Railroad was commenced, which was intended as a rail communication between the Ohio River and Lake Erie, Cincinnati and Sandusky being the termini. In 1837 the Erie & Kalamazoo Railroad received a Baldwin locomotive called the "Adrian," of the same type as the "Pioneer," now belonging to the C. & N. W. Railroad and shown at the World's Fair. If any of our readers can give us more information on this subject it will be thankfully received.

(14) T. E. O. Parsons, Kan., writes:

There has been an argument among the shopmen in regard to the question: Does an engine lose any power when she is on the dead center crowding against her own bearings? *A.*—The arguments on this question generally relate to the disadvantages of the crank, and some people see in a rotary engine an important advantage since it has no dead center. An engine at rest can exert no power on the side where the crank is on the center, because the force of steam on the piston will merely press the connections against the axle-box. That is not, however, looked upon as loss of power, because the power exerted by a certain length of crank is calculated from the greatest leverage—to the zero of the dead center. The pressure of steam on the piston is productive of two species of strains upon the crank-axle. When the crank is on the center the turning effect of the power applied to the piston is nothing. When the crank is on the quarter, the rotative tendency is greatest, as the full leverage of the crank can then be exerted. From that position the leverage gradually diminishes until the dead center is reached, when it is nothing. In figuring the rotative power that can be obtained through a crank the average rotative effort is taken. This is known to be as .6366 is to 1 for an entire revolution. When in the case of an engine with, say, 24-inch stroke, which is 12-inch of crank, .6366 is multiplied by 12, it gives 7.64 inches as the length of crank receiving constant rotative effort. This gives a basis for figuring the tractive power of a locomotive.

INDEX TO ADVERTISEMENTS.

SYNOPSIS

OF THE

Air-Brake Law Suit Decisions

VERDICT FOR THE

Westinghouse Air-Brake Co.

When [illegible] Air-Brake Co began [illegible] quick-action air-brakes several years ago the Westinghouse Air-Brake Co brought suits against them for infringement of patents on the quick-action triple-valve mechanism, and of a patent covering an engineer's brake-valve. Nearly a year ago the suits were heard before Judge Townsend, in the Circuit Court of the United States for the Southern District of New York

Judge Townsend has recently rendered [illegible] in these suits, and the principal [illegible] are given below.

Character of Defense.

The defense set up was non-infringement and lack of novelty, upon the theory that the inventions claimed had been [illegible] described by Westinghouse in [illegible]

History of Air-Brake Development.

In rendering the decision, the Judge [illegible] a brief history of air-brakes. The first practical air-brake is known as the plain brake, and was patented in 1869 It consisted of a pump operated by steam of the locomotive boiler, which compressed [illegible] into a reservoir located under the locomotive foot-plate This reservoir communicated by a pipe with a cock which [illegible] called the engineer's valve, and was located so as to be easily manipulated by the engineer

From this valve a pipe extended back under the tender and was connected to a similar pipe under the entire length of the [illegible] car by a flexible hose Each of the succeeding cars had a pipe similarly connected which was called the train-pipe From the train-pipe of each car a branch pipe connected with the forward end of the cylinder called a brake cylinder. This cylinder was provided with a piston, the stem of which was connected with the brake levers on the car When the engineer wished to apply the brakes he opened engineers' valve and the compressed air from the main reservoir flowed back through train-pipe and branch pipes into the brake-cylinder of each car, pushing the pistons backward, causing the piston stems to operate the brake levers and force the brake shoes against the wheels

When he wished to release the brakes he moved the valve so as to shut off the flow of compressed air from the main reservoir and to open a port leading from the train-pipe to the open air. Thereupon the compressed air in the brake cylinders escaped into the open air, the pressure of the pistons was removed and the pistons were pressed forward again by means of springs, moving the brake-shoes away from the wheels.

Weak Points of Straight Air-Brake.

This was a good practicable continuous brake, but it was open to certain objections. It was too slow when used on a long train, and there was danger of collision in case one part of the train broke away from the other for there was nothing to stop the part of the train detached from connection with the engine.

Invention of the Automatic Air-Brake.

About 1872 Mr. George Westinghouse, Jr , invented an improvement on the old brake, making it work automatically in case of accident. This is known as the automatic brake. It embodied the addition of an auxiliary reservoir and a triple-valve on each car. Each reservoir was of sufficient capacity to operate its brakes and supplied air to the brakes when they were put in action. The triple-valve was located at the junction of connections between pipes leading to the train pipe, the brake-cylinder and the auxiliary reservoir In addition to the three ports connecting the triple-valve with these parts, there was a fourth port leading to the open air

Operation of the Automatic Air-Brake.

This brake was radically different from the plain brake In the plain brake, all the compressed air to be used was stored in the main reservoir on the locomotive In the automatic brake, the main and auxiliary reservoirs and train-pipe were always charged with compressed air at working pressure to prevent the application of the brakes. When the engineer wished to apply the automatic brake, he moved the engineer's valve so as to cut off the flow of compressed air from the main reservoir and open a port from the train pipe to the open air The effect of this was to reduce the air pressure in the train-pipe. This caused the pressure in the auxiliary reservoir to be greater than the pressure in the train-pipe, which pushed down the piston of the triple-valve, closing the port from the branch-pipe to the train-pipe, and opening the passage between the auxiliary reservoir and the brake cylinder Thereupon the compressed air in the auxiliary reservoir flowed into the brake cylinder and applied the brakes. The brakes were released by recharging the train-pipe from the main reservoir with air that was of greater pressure than the air in the auxiliary reservoir This pushed up the piston of the triple valve, cutting off the flow of air from the auxiliary reservoir and opening the brake-cylinder to the atmosphere

The effect of this arrangement was that in case of accidents, where the train pipe was ruptured or opened, the brakes on all the train were applied automatically

The Graduating Feature of the Automatic Brake.

Important features about an efficient air-brake are those that enable it to be used so that the power may be gradually applied to effect what are known as service-stops, or to apply the power instantly with full force to effect what are known as emergency-stops. In the first case, air-brake pressure of 10 or 15 pounds in the brake-cylinders may be sufficient. In the latter case, a pressure of 70 or so pounds may be necessary This distinction came out strongly in the brake suit

Automatic Brake Not Satisfactory With Very Long Trains.

The automatic air-brake worked perfectly on short trains, but on very long trains it was not satisfactory. When the railroad companies began to apply air-brakes largely to freight trains, it was found necessary to ascertain how brakes, suddenly applied, would work on a train of fifty cars. Under the auspices of the Master Car Builders' Association a series of brake trials were made at Burlington in 1886 In these tests, it was found that so much time elapsed between the periods of application on the first and on the last cars of a train, that destructive shocks resulted The lesson of these tests was that the necessity existed for improvements on brakes which would make the application so quick that no severe shocks would be experienced with very long trains.

Burlington Brake Trials.

The brake trials at Burlington were renewed in 1887, and the Westinghouse Air Brake Co. used an improved apparatus covered by patent No. 360,070, granted to George Westinghouse, Jr. This brake did not materially reduce the shocks caused by sudden application to very long trains. The experts who attended these trials came to the conclusion that air-brakes, actuated by electricity, were necessary to prevent shocks when the trains were very long

Essentials of a Brake for Long Trains.

Several essentials appeared necessary for a brake to work satisfactorily on very long trains, and it was thought that they could not be secured by air pressure alone The following were the leading requirements

1 The regulation of the force to be applied to the brake-shoes so as to secure all necessary graduations, from the mere slackening of speed to the service stop, and from the service stop to the emergency stop.

2. The automatic operation of the brakes in case of accident

3. The practically simultaneous operation of the brakes on each car, so that, in long trains of freight cars, shocks might be avoided.

4 The control of all these operations by the engineer.

5 Certainty of operation under all conditions.

The Quick-Action Air-Brake Invented.

In this condition of affairs, George Westinghouse, Jr , set to work to overcome the difficulties. The result of his labors was the production of what is now known as the quick-action automatic brake, which was patented in January, 1888, in Patent No. 376,837 This brake was capable of handling a train of fifty freight cars successfully without causing shocks or dangerous strains to the machinery.

In the improved brake, the quick-action element was added to the automatic apparatus by such an arrangement of the triple-valve in connection with vents on each car as to make the opening of such vents and the consequent reduction of train-pipe pressure practically simultaneous on all cars. This emergency-action is secured by means of a separate supplementary piston and valve in a supplemental valve-chamber below the main slide-valve of the triple-valve device This chamber connects the train-pipe with the train-cylinder, communication between them being regulated by the supplemental valve opening outwardly or downwards, and a check-valve opening inwardly or upwards. In the bushing which forms the valve-seat of the main slide-valve are four ports governed by this slide-valve, One of these ports leads to the brake-cylinder, two lead to the supplemental valve-chamber on the upper or inner side of the supplemental piston, and one leads to an exhaust-port

Emergency Action.

When an emergency stop is to be made the engineer throws his engineer's valve wide open, thereby causing a sudden and material reduction of pressure. The excess of auxiliary reservoir pressure then forces the main piston stem against the stop 21, overcoming the tension of the spring, and driving the main piston to the extreme limit of its stroke This uncovers the ports leading from the auxiliary reservoir to the supplemental valve chamber The auxiliary reservoir pressure drives the supplemental piston outwardly or downwardly against the stem of the supplemental valve and forces it from its seat Thereupon the preponderance of train-pipe pressure in the train-pipe opens the check-valve and the air from the train-pipe rushes directly from the brake-pipe to the brake-cylinder.

The result of this operation is two-fold, it hastens the application of the brake on the car on which it is operated, and, by venting the train-pipe, hastens a similar reduction of pressure and consequent similar operation in the next succeeding triple-valve device on the next car

Outlines of First Suit.

In the suit based upon Patent No. 376,-837, it was alleged that the New York Air-Brake Company infringed the claims 1, 2, 3 and 6.

Claims of Patent 376,837.

The first claim is "In a brake mechanism, the combination of a chamber or casing, having direct connections to a brake cylinder and to a brake-pipe respectively, a valve controlling communication between said connections, and a piston or diaphragm which is independent of and unconnected with a triple-valve piston, and is actuated by pressure from an auxiliary reservoir in direction to impart opening movement to said valve, substantially as set forth "

The second claim includes a check-valve controlling communication between said valve and the brake-pipe passage of the chamber

The third claim is " In a brake mechanism, the combination, with a triple-valve of a supplemental chamber or casing having passages leading to a brake-cylinder and to a brake-pipe respectively, a supplemental piston operating independently of the triple-valve piston, and adapted to impart opening movement to said supplemental valve, and a passage establishing communication between said supplemental piston and an auxiliary reservoir substantially as set forth."

Devices used by Defendants.

Defendants have used two devices, the first known as their "quick-action triple-valve," the second as their "modified quick-action triple-valve" It is claimed that both are infringements of the Westinghouse patent

Each of these devices has a chamber or casing, with direct connections to brake-cylinder and train-pipe, and a controlling valve as in the Westinghouse patent Each has an emergency piston and valve and check-valve

New York Air-Brake Co.'s Triple-Valves.

The first form of defendants' apparatus has two emergency pistons and valves, or rather one emergency piston and valve, actuated by a sudden or large reduction of pressure, as in the Westinghouse apparatus, and connected by means of a port with a supplemental piston and valve and check-valve, like the single emergency piston-valve and check-valve of the complainants.

The second or modified apparatus differs from the first in the elimination of one of the pistons with its valve, and part of the emergency attachment and modification of the check-valve.

Pretense of Defendants.

The defendants claim that their emergency apparatus, as well as that of the Westinghouse, is merely the combination of an automatic relief-valve described by Westinghouse and others in 1875, in patent No. 162,405 The purpose of this invention was to facilitate the escape of air from the brake-cylinder in the old straight air-brake. The claim was made that this old invention was embodied in the Westinghouse patent 376,837, on which this suit was brought.

The Quick-Action Mechanism a New Invention.

In this connection, Judge Townsend says: "I do not think this patent anticipates or limits in this connection patent No. 376,837, for the following reasons:

'The sole object of the invention was to quickly release brakes in the direct system. It was intended to obviate the difficulty arising from the fact that, in the direct system, the escaping air being expelled simply by its own expansion, came out very slowly. It was not adapted to the application of brakes or in any way to the automatic brake system, although that system had then been invented.

Counsel and experts for defendants admit that radical and material modifications were required before it could be practically applied to railroad service under the automatic system.

'There is no suggestion in the patent of any way in which it could be adapted to the automatic system, nor, if so adapted to apply the brakes, does it appear how it could be operated to release them. No provision is made for graduation for ordinary service stops in any case.'

A New and Valuable Invention.

Counsel for defendants having argued that the invention referred to, having shown how air could be released quickly from a long pipe, it was easy to apply it in a different way. This point is met by the fact that, if this was a thing that any competent mechanic could do, why was George Westinghouse the only person to do it?

Even if Mr. Westinghouse, in patent No. 376,837, did, as claimed by the defendants, did throw his mind back to patent 162,465, and use it as a basis for part of the contrivance of patent 376,837, he did not re-invent patent 162,465, but he invented and created a new device, adapted to new conditions and developed in new combinations, which produced new and different results."

Various decisions were quoted to sustain this opinion.

Each Patent Marked Decided Progress in Brake Mechanism.

Counsel for defendants contended that all the essential elements in the patent under which the suit was brought were anticipated in patents 162,465, and 360,070, the latter covering the improvements embodied in the Westinghouse brake tried at Burlington in 1887. This contention is very carefully considered, and evidence quoted to prove that each of the various patents involved had important elements which did not conflict with or anticipate the others. The opinion was expressed that each of the patents 162,465, 360,070, and 376,837, marked a forward step in the progress of the freight brake system, and that each contributed an important and essential element of invention thereto.

First Successful Quick-Action Apparatus.

"It appears that the apparatus constructed under patent 376,837 was the first successful embodiment of these great inventions, and furnished the first and only practical solution of the problems of automatic quick-action freight brakes.

"It seems to me most significant that with patent No. 360,070 before the world for six months, and under the pressure of competitive trials, no one so grasped the inventions claimed to be disclosed in patent No. 360,070 as to embody them in a successful working apparatus until after the patent in suit had been applied for, and that when defendants constructed an apparatus, they adopted the emergency piston and valve of the patent in suit.

The Patent Has Been Infringed.

"As patent 376,837 accomplished this result by the use of a separate piston, and as defendants' apparatus have accomplished this result also by the use of one or two separate pistons, they must be held to have infringed the first and third claims of said patent."

After considering and overruling objections based on the language of the claims of patent 376,837, the decision proceeds:

Action of Defendants' Triple-Valve.

"It remains to further consider certain suggestions in regard to the piston and supplemental piston of defendants' earlier device.

"When this emergency piston is called into operation by a sufficient reduction of pressure, it is not, as in complainants' device, so driven by auxiliary reservoir pressure as to act directly on the emergency valve, but when so forced down it opens a port whereby train-pressure is admitted to the upper side of the other piston, which, being thereby forced down, imparts opening movement to an emergency valve leading to the brake cylinder.

"We have here the triple-valve piston and two other pistons used to accomplish the work of the one piston in complainants' device, and defendants claim that in their device there is not the combination of triple-valve piston and emergency-valve, because the first of these two pistons does not impart opening movement to the emergency-valve, its only function being to uncover a port whereby air is admitted to the brake-cylinder, and the train-pipe is vented.

"They further claim that the second supplemental piston in said device is not actuated by reservoir pressure, but by train pressure.

"Of the two separate or emergency-pistons of the defendants, one opens a port which admits train pressure to the other. The former is directly actuated by pressure from the auxiliary reservoir. The latter is directly actuated by train pressure. But the latter is indirectly actuated by pressure from the auxiliary reservoir in the sense that such pressure necessarily results in operating it through the intermediate operation of the former.

Practically the Westinghouse Quick-Action Triple-Valve.

"The question is, whether this combination of devices is the same as device of complainants. It seems to me that it is. The component parts of the combination operate to perform the same function and to produce the same result.

"It is merely dividing complainants' piston into two parts, so arranged that the action of one necessarily causes the action of the other in the same way as though they were one."

Reference was made to claims of defendants as to differences in their device when not in action, and to admissions that it was inferior to that of complainants. Concerning these points the decision says: "The question is, whether the operation of defendants' device when in action is the same and produces the same results as that of complainants?

"What has already been said has been directed chiefly to the combination described in the first claim of complainants' patent. The additional check-valve claimed in the second claim is found in the defendants' first device.

"The elements of the third claim are in the main the same as in the first claim, and the additional element, a passage between the supplemental piston and auxiliary reservoir, is found in defendants' device.

Both Defendants' Triple-Valves are Infringements.

"As a result of these considerations, I have reached the conclusion that the first form of defendants' apparatus, the 'Quick-Action Triple Valve,' infringes the first three claims of the patent in suit, and that the second form, the 'Modified Quick-Action Triple Valve,' infringes the first and third claims of the patent in suit."

Divisional Patent.

Consideration is next given to the alleged infringement of claims 1 and 2 of patent 448,827, granted to George Westinghouse, Jr., in 1891, for an air-brake. This was a divisional patent, having been originally applied for as a part of patent 376,837. The object of the invention was "to provide means for effecting the rapid admission of fluid under pressure to a desired delivery receptacle by means of, and coincidentally with, a reduction of pressure in the receptacle of a fluid supply," and that the means by which this object was to be attained could be used with or without a triple-valve apparatus.

The defendants admit infringement, but urge that the claims are void, alleging that the appliances had been described in previous patents, that alleged amendments to the patent were enlargements, not amendments, and that the claims were designedly too broad.

The Divisional Patent Good.

Among the points made in deciding this suit are the following:

"This divisional patent fairly represents an invention distinct from those which preceded it. The problem presented was, how to provide for a certain, sure operation of the emergency valve, and how to rapidly apply brakes for an emergency stop, or by means of an emergency reduction of pressure."

"The solution was accomplished by a valvular appliance so arranged as to operate independently of the triple valve, although capable of being used in the combination with it.

Essence of the Invention.

"The essence of the invention lies in providing a means whereby the emergency apparatus may be directly brought into efficient operation, although the triple-valve may be stuck fast."

"The distinct invention in patent No. 448,827 is the combination of the valve with the triple-valve mechanism, under such relations that it does not need any movement on the part of the triple-valve mechanism in order to operate it.

"If the invention embodied in patents Nos. 360,070, 376,837 and 448,827 be considered in its entirety, we shall see that it is for the fluid-pressure car brake, consisting of various combinations, operating in different ways. The object to be attained by such invention is the successful practical operation of the brakes on all occasions. One of the exigencies to be guarded against in providing for all contingencies is the possible sticking or wedging of the triple-valve. While, therefore, the apparatus covered by patent No. 448,827 is adapted to be used in connection with the triple-valve device and in combination with a brake apparatus normally operated by such device, yet it is designed to be so constructed that upon a considerably greater reduction of pressure than that required for a service stop, the pressure from the reservoir on top of the diaphragm will cause it to work in any case. By this means the mechanical dependency of the emergency part of the apparatus upon the movement of the other part is eliminated."

"I am forced to the conclusion that George Westinghouse described, in the original specification of this patent, an improvement upon previous inventions, which was capable of use independently, or as part of a combination, but which owed its utility in such combination to its independency of operation in emergencies, in supplying the lack of the other part of the combination, and that this useful element involved invention, in order to adapt it to such combination, and to the exigencies of the automatic quick-action freight brake system."

The Engineer's Valve.

In the suit for infringement of patent 222,803, granted George Westinghouse, Jr., on engineer's valve, the defendants deny infringement. In deciding this suit the inventions are compared, and their identical and differing features pointed out. The following are extracts from the decision:

"Defendants' device has a greater capacity for automatic closing of the escape valve than that of the complainants."

"But while in these respects the device of defendants may be an improvement upon that of complainants, it does not seem to me to show that defendants have not appropriated the invention of complainants."

"And because of these conclusions, supported by the admissions of defendants' experts that the device of defendants contains the elements combined, as claimed by complainants, I am of the opinion that defendants' device infringes claims 2, 3 and 4 of patent No. 222,803."

Petition of Defendants for Permission to Sell Brakes.

After these decisions were rendered the New York Air-Brake Company petitioned the Court for permission, pending an appeal to the Court of Appeals, to sell about 3,000 car equipments which are finished.

Would Pervert the Decision of the Court.

In refusing to grant the petition, the following reasons are given:

"To permit the defendants to sell the infringing equipments at a fixed rate for each apparatus, would be to pervert the decision of the Court from an injunction into a license. It would deprive the patentee of the monopoly granted him under the law of the United States, and establish an infringing rival in a competing business.

"Furthermore, as it is impossible, in this case, to estimate the damages and profits from the infringment, an injunction is complainants' only available remedy.

"The motion of defendants is, in effect that they may be permitted to make a profit of about one hundred thousand dollars out of apparatus manufactured with full notice of complainants' rights, and during the pendency of the suits in which they are now enjoined.

"From the statements contained in a circular letter sent out by defendants immediately after the filing of the opinion, and produced at the hearing on these motions, it would appear that the denial of the motions cannot operate harshly upon the defendants. In said circular they stated that, 'so far as the freight triple-valve is concerned, the decision is unimportant, for no principle is involved, and only trifling and unimportant changes are necessary to make our triple-valve free, in view of the very narrow construction given to the Westinghouse patents by the court.'

"If this statement does not apply to the equipments on hand, they need only be held, subject to the final decision of the appellate court.

"But the defendants cannot complain, if they are merely subjected to the necessity of making trifling and unimportant changes in such apparatus as they may manufacture during the intervening period."

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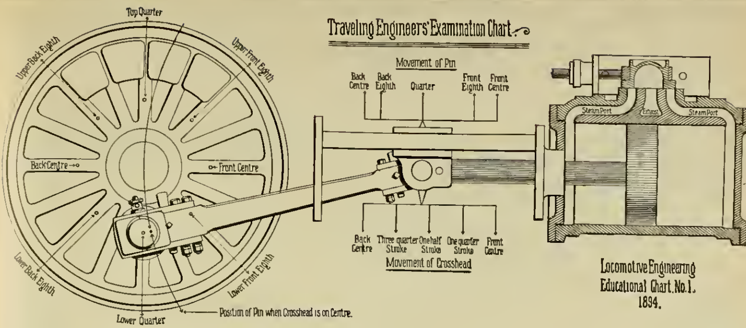

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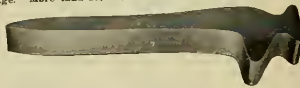

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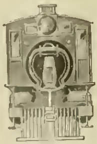

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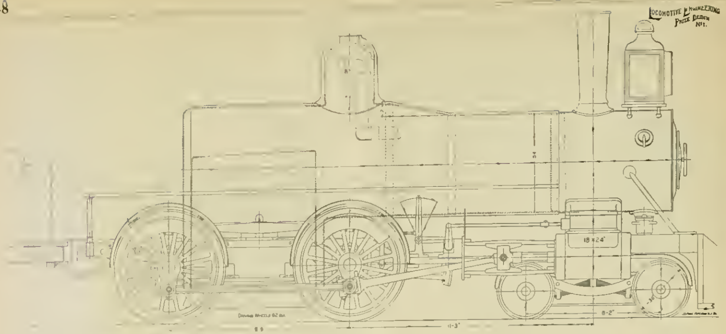
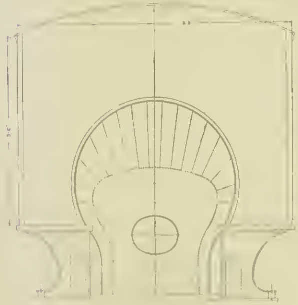
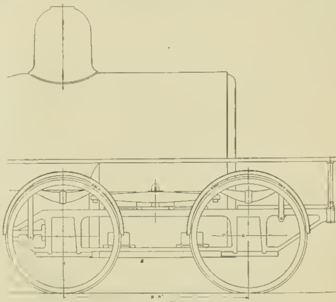
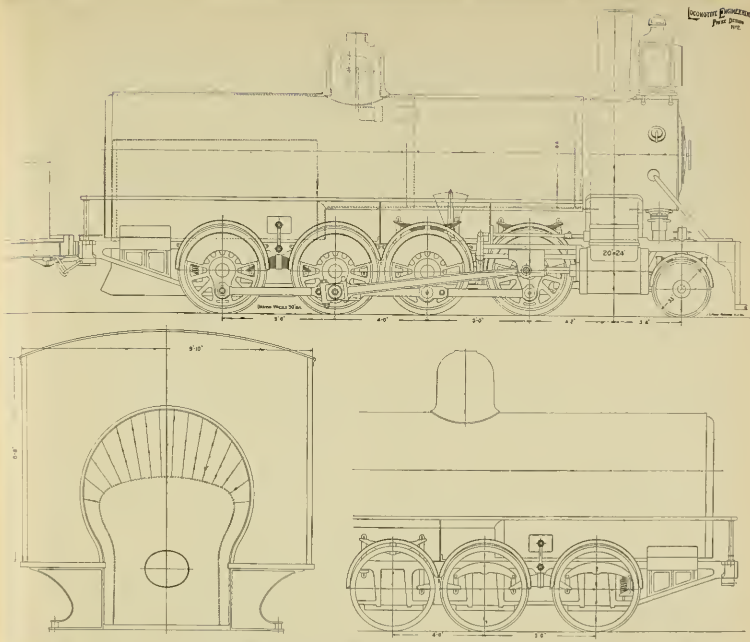






Chance to Earn $100, $50 or $25. See Particulars on Page 43.



$175.00 in Prizes to Finish this Design. See page 43.

LOCOMOTIVE ENGINEERING PRIZE DESIGNS.

$350

In Rewards for Best Designs in Cab and Boiler Fittings.

SEE DRAWINGS ON PAGES 40 AND 41.

THE number of men scalded and cooked to death in wrecks is so great that little notice is taken of it. Practically nothing at all has been done, or attempted, to make Locomotive Boiler Fittings safer for those who handle them. The details of some of these wrecks are heart-rending. Instances are on record, and are common, where men have been held down by wreckage, but uninjured, until slowly cooked by escaping steam—one fireman was found with steam pouring out of his mouth and nose; the small pipe to the steam gauge had broken off and the end had partly penetrated his side (a wound of little consequences had there been no steam there). This is only a sample.

Nor does this danger exist for enginemen alone. Only last year a locomotive on the Colorado Midland Road struck the side of a loaded passenger car. The check broke off and killed the passengers—the force of the collision was not enough in itself to overturn the car. The Quincy wreck on the Old Colony was so frightful because the victims were imprisoned in a car crushed over the wrecked locomotive. Half the fatalities of railroad wrecks, and more than half the tortures can be prevented if the steam can be kept in the boiler.

Many locomotives are extremely uncomfortable and unhandy; boiler fittings are located in places where they are liable to be broken; are hard to handle or to pack; seats are poor and located where men cannot use them and handle the engine properly. Brake valves are located where they get hot and stick; where they are hard to reach, etc. Those who ride the engines day after day know how uncomfortable many of them are. All this can be made better.

The running repairs are troublesome and expensive. Grinding in valves takes time; takes the engine out of service, and is long neglected on that account. Is it necessary to grind in valves? Half the repairs of injectors is to the priming apparatus. Are primers necessary? Half the steam pipes in a cab are where they will be touched in handling some valve, where some of them are sure to be broken off in a wreck, and are in the way of the crew. Are they all necessary or can't they be shortened? There are a thousand reasons for improvement—life-saving reasons; comfort-promoting reasons; time-saving and money-saving reasons.

For all of these reasons LOCOMOTIVE ENGINEERING opens a **prize contest** to see if the brains of American railroad men can't be employed to make a bad thing better than it is.

THE ENDS SOUGHT.

The above amount, $350, will be paid in prizes for the best design of Boiler and Cab Fittings for two classes of Locomotives—freight and passenger—showing the greatest improvement over present practice, tending to:
1st. Greater safety for the lives of the engine crews under any and all circumstances—especially in wrecks.
2d. Convenience in handling the locomotive, comfort of crew—consistent with best road service.
3d. Economy of time and money in keeping up running repairs.

THE PRIZES.

Design No. 1. One Hundred Dollars ($100) cash for the best design for the Eight-Wheeled Passenger Engine. Fifty Dollars ($50) cash for the second best design. Twenty-five Dollars ($25) cash for the third best design.

Design No. 2. One Hundred Dollars ($100) cash for the best design for the Consolidation Freight Engine. Fifty Dollars ($50) cash for the second best design. Twenty-five Dollars ($25) cash for the third best design. Five Dollars ($5) cash to be paid for each design published that has not taken a prize.

THE JUDGES

will be selected by lot from the following callings: One Superintendent of a Locomotive Works; One Superintendent of Motive Power, from a road having over 300 locomotives; One Chief Draughtsman of a locomotive works or general railroad shop; One Traveling Engineer, selected from the membership of the Traveling Engineers' Association; One Locomotive Engineer in actual service, from a list of the most prominent B. of L. E. men in this country. The names of the members of this Committee will be announced in the January number of LOCOMOTIVE ENGINEERING. They will meet at the Master Mechanics' Convention at Saratoga Springs, N. Y., in June and award the prizes, and the cash will be paid on or before July 4th. In case there is an absentee in the Committee, the remainder of them will elect a man from the same employment, if possible, as the absentee.

CONDITIONS.

Separate designs and written descriptions must be submitted for each class of engine. Persons submitting design must place on the drawing some distinguishing mark (such as initials, *nom de plume* or device), and no name must appear on the drawings or in the written description of same. Drawings for one class only, together with written description, must be sent in one package and a sealed letter stating the name of the person or persons who submit the drawings marked as described. This letter will not be opened until after the judges have made the awards—they will judge on the merits of the designs alone. Nicety of drawing will not secure the reward, though it is to be commended—it is the *idea* that is wanted—the suggestion that can be used by railroads and by locomotive builders for the improvement of locomotives in the three lines we have laid down, namely: safety of crew under all circumstances; convenience in handling, and economy in keeping up running repairs.

One person may submit as many designs as he cares to, but each must be separate, and use a different distinguishing mark. More than one person can have an interest in one design if desired. Drawings must be on white paper with black ink—no other will be considered. The printed drawings may be finished out, or new and larger ones submitted, but in each case they must be complete, and the same as printed design. Written description must briefly point out the intended improvement in each device and explain the working of same, but the intention is that the drawings shall tell the whole story. Unusual or new devices may be shown in sectional sketches on margin of drawings, but be it remembered that this is not a contest of merits of engine devices; the rewards will be given on the merits of the whole arrangement. The cab must be limited in width to the height and width marked on drawings. It can be made as long as desired and placed on engine in any position wanted.

WHAT WILL BE FURNISHED.

Drawings of a complete locomotive, except cab and operating handles, lubricators, injectors, air brakes, etc. The throttle valve stem is left ready to connect. Designer can put on any kind of a throttle he thinks best and bring it out wherever he likes.

The tumbling shaft arm extends up the usual height ready to connect to the reach rod.

WHAT TO DO.

Take either of the incomplete drawings and finish them. Put on everything necessary that is not shown. Everything above the running boards.

The passenger locomotive must be equipped with automatic air brakes, sight feed lubricators, steam heat connection and whistle signals.

The freight locomotive will have air brakes, sight feed lubricators and all modern improvements.

Locate and draw in the main drum, engine air brake equipment complete, throttle, reverse lever, gauge cocks, steam and air gauges, blower, cab light, etc. Decide on kind of injector and valves and locate all of them, arrange all hose connections between engine and tender Locate whistle lever or cord, lay out windows of cab and arrange to handle and fasten them, choose design of check valves and all piping and boiler connections. Locate tank hand brake, either in sketch or description, locate shake levers, dampers and slide pullers, sand lever, cylinder-cock lever, seats, arm rests, etc.—in fact, everything used to handle the locomotive.

WHO MAY SUBMIT DESIGNS.

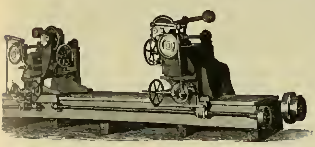
This contest is open to the world. There is absolutely no limit as to who may take part Large prints of the drawings, in tubes (not folded), will be sent free, on request to any regular subscriber of LOCOMOTIVE ENGINEERING, or those who send subscriptions for a year with the request. We will have to ask others to send 20 cents for postage.

All the Announcements as to Prize Winners and Engravings of Successful Designs will be printed only in LOCOMOTIVE ENGINEERING.

BEMENT, MILES & CO. PHILADELPHIA, PA.

BUILDERS OF

METAL-WORKING MACHINE TOOLS,

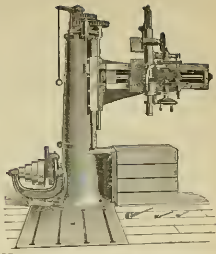


FOR

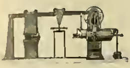
Locomotive and Car Builders,
Railroad Shops, Machine Shops,
Steam Forges, Ship Yards,
Boiler Shops, Bridge Works.

STEAM ◉ HAMMERS

FOR WORKING IRON OR STEEL.



NEW YORK OFFICE: EQUITABLE BUILDING. GEORGE PLACE, Agent.



William Sellers & Co., Incorp.

PHILADELPHIA, PA.

MANUFACTURERS OF

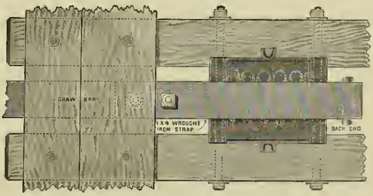
IMPROVED MACHINE TOOLS.

New Boring Mill for Car Wheels—With Automatic Chuck, *closing* when table is started, *opening* when table is stopped; and with Patent Safety Power Crane. Operator spared all hard work.

Lathes, Planers, Drill Presses, Steam Hammers, Steam and Hydraulic Riveters, Punches and Shears, Bolt Cutters, Wheel Presses, Car-Wheel Borers, etc. High Speed Power Traveling and Swing Cranes, Testing Machines, etc. Turn Tables for Locomotives. Shafting, Pulleys, Couplings, Hangers. Self-Adjusting Injector of 1876. Self-Acting Injector of 1887.

ECONOMY in Repairs, Saving in Labor of Application, Absolute Protection to Draft Springs are a few of the Claims for the Butler Drawbar Attachment. • • • •

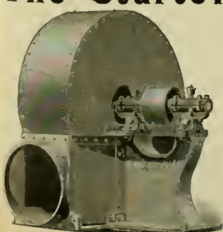
The Yoke Device is becoming a general favorite with users of AUTOMATIC COUPLERS. ☞ Try it and be convinced.



The number in use constantly increasing, and the new strengthened castings are giving entire satisfaction.

THE BUTLER DRAWBAR ATTACHMENT CO., CLEVELAND, OHIO.

The Sturtevant Steel Plate Exhausters



For Removing Smoke from Forges, Refuse from Wood-Working Machinery, Etc.

THE STURTEVANT STEAM HOT BLAST APPARATUS

For Heating Railroad Shops, Drying Lumber, Etc.

STEEL PRESSURE BLOWERS FOR CUPOLA FURNACES AND FORGE SHOPS.

B. F. STURTEVANT CO., Boston, Mass.

BRANCHES:

91 Liberty St., New York. 16 So. Canal St., Chicago. 135 No. Third St., Philadelphia.

SOME NEW FEATURES !!

LOCOMOTIVE ENGINEERING will have quite a number of entirely NEW FEATURES for **1894.** New Dress! New Cover! New Ideas!

PROMINENT AMONG THEM WILL BE THE INTERESTING:

Prize Locomotive Designs.

$350 CASH IN PRIZES

For the Best Plan of Arranging Cab and Boiler Fittings on a Locomotive for the safety of the crew, comfort in handling the engine, and economy of repairs. The prize-winning designs will be published during the year.

Block Signals.

We have secured from the pen of D. B. McCoy, Signal Engineer of the N. Y. C. & H. R. R. R., a Series of able Articles on Block Signals. The writer tells "What a Block Signal Is," and "How it Does It." If you want to post up on block signals, just read these articles.

Air-Brake Doctors

will be interested in the Series of Articles commencing in the January issue, written by Paul Synnestvedt, and entitled "Diseases of the Air Brake System: their Causes, Symptoms and Cure." These brake articles tell what to expect when any part of the brake acts in a certain way, and then what to do to remedy it. There will be a complete, illustrated chapter on each vital part of the brake mechanism. There will be a chapter each under the following headings: Pumps, Governors, Main Drum, Engineer's Brake Valve, Train Pipe, Auxiliary Reservoir, Brake Cylinder, Triple Valve, Pressure-Retaining Valve, Foundation Brakes, and Miscellaneous. This series of articles will be something new in a new line, and is destined to be of great benefit to all who work with or on air-brakes.

The Injector,

An Ever Interesting and Instructive Subject. A series of articles on Injectors will appear during the year. These are from the pen of an Injector-maker, who has used them on a locomotive as well as made them. They will tell all the How, When and Why about Injectors.

Profit-Sharing for Railroad Employes.

A Plan of Settlement of the Capital and Labor Controversy, by M. E. Ingalls, President of the C. C. C. & St. L. and the C. & O. Railroads. A live subject by a live man.

The Commercial Value of Compound Locomotives.

An Opinion on Compounds from the Financial Side of the House will be contributed by Mr. S. M. Felton, President and Receiver of the Queen & Crescent Road.

Discipline Without Punishment.

One of the Most Successful General Superintendents in Railroad Work will explain how he keeps up discipline of train and enginemen—and he never lays a man off or fines him.

Keeping Shop Accounts.

A System of Keeping Accounts of Material and Work in Railroad Repair Shops. These articles are by a well-known railroad officer and describe a system with which he is thoroughly familiar, if not the originator of most of it.

Railroad Coppersmithing.

By JOHN FULLER, Sr.

Already commenced, will be continued and finished these articles are a school for sheet-metal workers.

Economy in Compressing Air for Shop Use

will be the Title of a Paper by R. M. Dixon, Engineer of the Safety Car Heating and Lighting Co. No engineer of his country has a more varied experience than Mr. Dixon in pumping air, gas and other vapors.

Locomotive Tenders.

A Comparison of the Weight, Cost, Repairs and Capacities of the American Eight-Wheeled and the European Six-Wheeled Designs. An interesting subject by a man who knows something about both kinds.—Mr. W. F. Dixon, Chief Draftsman of the Rogers Locomotive Company.

Sampson Fox,

the Great English Steel-maker, the father of the Pressed Steel Industry, has promised us an article on Boiler Steel, its Manufacture, Inspection, Test and Care. Mr. Fox writes and talks on steel in the most entertaining way—because he is the master of the business.

THESE ARE A FEW OF THE MANY INTERESTING ARTICLES WE HAVE LAID PIPES TO.

WATCH THE PAPER.

1894

DON'T FORGET that we send **THREE EDUCATIONAL CHARTS** to every subscriber whose name is on the list to December, 1894—and to no one else.

YOU DON'T want to miss a chance at those Prize Designs. If you don't compete you want to see what schemes are proposed.

LOCOMOTIVE ENGINEERING will be made so interesting for **1894** that every subscriber will be ashamed that he took so much for the money.

Blessings are scarce this year! Are you one of the Anointed?

Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock.

VOL. VII, No. 2. NEW YORK, FEBRUARY, 1894. 20 Cts. Monthly $2.00 Per Year.

The Unexpected in Mechanics.

Every-day things, which are perfectly familiar to mechanics of one class, are totally unintelligible to the workers in another branch, remarked Professor Sweet in talking on the above subject. Men who have worked a life time in fashioning cast-iron under the lathe, are greatly surprised on learning that the same material, when employed in the heating-pipes of a blast furnace stove, grows from six inches to a foot in length from constant use. The furnace man is equally unprepared to hear that the core bars for casting pipes lose as much as three inches in casting twenty or thirty pieces.

In practice we use a piston-rod packing of easy fitting babbit bushing. When these bushings become sufficiently worn to leak, we close them by compressing them in the cylinder of a hydraulic press. In this operation a mandrel somewhat smaller than the piston-rod is put inside, and with all the pressure we can bring to bear, we have never been able to compress the bush so as to grasp the mandrel tight. Yet occasionally we have those bushes seize the rod so tight when the engine is running that the firm hold breaks the bushes asunder.

When the lawn mower was first introduced, the inventor was considered little short of a mechanical heretic to imagine that he could get sufficient traction with two light wheels to rotate a cylinder six times their own weight, at six times that velocity and cut the grass at the same time.

The worm that drives a Sellers' planer does not wear out half so fast as theory says it should, and there is possibly something unexpected about it even to the makers themselves.

An engine which had been running a year at 185 revolutions a minute on an unusually solid foundation, began one day, without apparent cause, to shake end-wise, and before night had shaken itself loose. As no harm resulted and work was pressing, the repairing of the foundation was postponed until vacation time, about a month distant. Before that time arrived the shaking ceased and the engine ran perfectly smooth in spite of the impaired foundation.

Another curious case was two similar boilers which were connected by necks at top and bottom and a fire started under each of them, the boilers being about half full. The water behaved very strangely, all going from one boiler to the other. When the play was at its height the boss, considering the lives of the men and safety of the premises of more value than the interests of science, ordered the fires drawn and the cause could never be determined.

The readers of this paper have done us proud with their congratulations. We appreciate all of them, and will try to deserve the most of them. Modesty forbids that we publish a few hundred letters on the subject; we don't even keep them, as reading any number at once might produce swelled-head, or make us satisfied with Locomotive Engineering. This we are not, and don't intend to be—each succeeding issue must be better than the last one.

The Fall Brook Railway have recently raised the running boards on some of their consolidation locomotives and it seems to be an improvement. The running boards on very large boilers are much too low to stand on to do anything on the top of the boiler, while the board is too low to make inspection of the engine as easy as it might be, besides, where no wheel-guards are used, it keeps things cleaner, or rather exposed where they are more liable to be cleaned.

Pittsburgh Compound Passenger Locomotive.

The Pittsburgh Locomotive Works exhibited at the World's Fair, among other locomotives, a compound eight-wheeler that attracted universal attention and admiration. She was painted green, and her rods, cross-heads, guides, etc., were finished so ely that many railroad men thought they were nickel-plated—there was no nicer finished engine there.

Both cylinders were lagged up to the same size, and both piston-rods had extensions through the front cylinder head—tail rods.

The Pittsburgh two-cylinder compound differs from other two-cylinder compounds in that, when working simple the high-pressure cylinder exhausts direct to the atmosphere, and they can be run simple as long as desirable.

The cross section through cylinders shows the arrangement of intercepting and reducing-valve, steam pipes, passages, etc., and the small engravings show the details of these valves.

Fig. *A* shows position of intercepting-valve when working simple, the passage to receiver being open to reducing-valve, which is free to act and admit live steam to receiver. The high-pressure exhaust is also open to the atmosphere, as shown. In Fig. *B* the intercepting-valve is shown in forward or proper position for working compound, with passage between reducing-valve and receiver closed, while the exhaust of high-pressure cylinder is diverted from the open air to receiver, as indicated. In the cab is placed an automatic air or steam reversing cylinder, actuated by movement of the reverse lever, as follows When lever is down or at full stroke, the intercepting-valve is in position indicated by Fig. *A*, permitting admission of live steam to receiver; but the moving of reverse lever one or more notches opens valve which admits pressure to reversing appliance, and intercepting-valve is moved to position shown by Fig. *B*. The dropping back of lever to full stroke again changes the valve, and the engine is thrown into simple as before.

Complete drawings shown herewith will make every detail of construction plain, and sizes are given in the specifications as follows

WEIGHTS AND GENERAL DIMENSIONS.

Gauge of track, 4 ft 8½ in.

Total weight of engine in working order, 112,550 lbs.

Total weight on drivers, 72,000 lbs.

Driving-wheel base of engine, 8 ft.

Total wheel base of engine, 22 ft [illegible] in

Total wheel base of engine and tender, 47 ft ½ in.

Extreme length of engine and tender, 57 ft 0¼ in

Length of main rod, center to center, 85$\frac{5}{16}$ in.

Height from rail to top of stack, 15 ft.

CYLINDERS, VALVES, ETC

Cylinders cast in one piece with half-saddle.

Transverse centers of cylinders, 80 in.

Diameter of high-pressure cylinder, 19 in.

Diameter of low-pressure cylinder, 29 in.

Stroke of pistons, 26 in.

Kind of pistons, cast steel with followers

Piston-rods, steel, 3½ in. diameter

Size of steam-ports, high pressure, 1⅜ x 16 in.

Size of steam-ports, low pressure, 1¾ x 18 in.

Size of exhaust-ports, high pressure, 2½ x 16 in.

Size of exhaust-ports, low pressure, 3¼ x 18 in.

Pittsburgh Compound Passenger Locomotive

Kind of valves, Richardson balance.

Greatest travel of slide-valves, high pressure, 5 in.

Greatest travel of slide-valves, low-pressure, 6 in.

Outside lap, high pressure 1 in

Outside lap, low pressure, 7/8 in

Inside clearance high pressure, [illegible] in

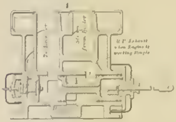
Inside clearance, low pressure 1/8 in

Lead of slide-valve in full stroke, high pressure, 1/16 in

Lead of slide valve in full stroke low pressure, 1/16 in

BOILER.

Material in shell (Carnegie Steel Co., Ltd.) homogeneous steel



Position of Valve when Engine is working Simple

Material in firebox (Carnegie Steel Co., Ltd.) homogeneous firebox steel.

Thickness of shell, throat and back head, ½ in., ⅝ in. and ½ in.

Thickness of firebox sides, door, crown and tube sheets, 5/16 in., ⅜ in. and ½ in.

Type of boiler, reduced shell

Diameter of boiler at smallest ring, 58 in.

Diameter of boiler at back head, 67 in.

Kind of horizontal seams, butt joints, [illegible] strapped and sextuple riveted.

Kind of circumferential seams, double riveted.

Dome, height and diameter, [illegible] x 30 in.

Crown sheet, supported by radial stays, 1⅛ in. diameter

Stay-bolts, iron, Brown & Co.

Stay-bolts, 1 in. diameter, spaced 4 in. from center to center

Tubes, Spang, Chalfant & Co.

Number of tubes, 240

Diameter of tubes, 2 in.

Length of tubes over tube-sheets, 10 ft. 10 in.

Length of firebox inside, 96 in.

Width of firebox inside, 40⅛ in.

Water space, sides, back and front, 4 in., 3½ in., and 4 in.

Water-bar, 3½ in. thick, double riveted

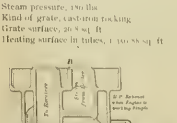
Water test, 270 lbs.

Steam pressure, 180 lbs.

Kind of grate, cast-iron rocking

Grate surface, 26.8 sq. ft.

Heating surface in tubes, 1,350.88 sq. ft.



Position of Valve when Engine is working Compound

Heating surface in firebox, 123.17 sq. ft.

Total heating surface, 1,474.05 sq. ft.

Smokebox, extended, with deflector, netting and spark-ejector.

Kind of smoke-stack, straight

Smallest inside diameter of smoke-stack, 15⅞ in.

Kind of exhaust-nozzle, single

Diameter of exhaust nozzles (4 sizes), 4½ in., 5 in., 5¼ in. and 5½ in.

Brick arch in firebox, supported on tubes, 2½ in. dia., No. 6 W. G.

WHEELS, ETC.

Diameter of driving-wheels, outside of tires, 72 in.

Diameter of driving-wheels, centers, 66 in.

Make of tires, Latrobe Steel Works.

Size of tires, 3 x 5½ in.

Kind of driving axles, steel

Diameter and length of journals, 8 x 10 in.

Kind of crank-pins, steel

Diameter and length of main crank-pin journal, 5½ x 6 in.

Diameter and length of main crank-pin parallel rod journal, 4½ x 4 in.

Diameter and length of back crank-pin parallel rod journal, 4½ x 4 in.

ENGINE TRUCK.

Type of truck, 4-wheel, rigid center.

Type of truck wheels, cast-iron spoke center, steel tired.

Make of tires, Latrobe Steel Works

Size of tires, 2½ x 5½ in.

Kind of axles, steel.

Size of journals, 5½ x 10 in.

TENDER.

Weight of tender, empty, 30,600 lbs.

Weight of tender, with fuel and water, 73,770 lbs.

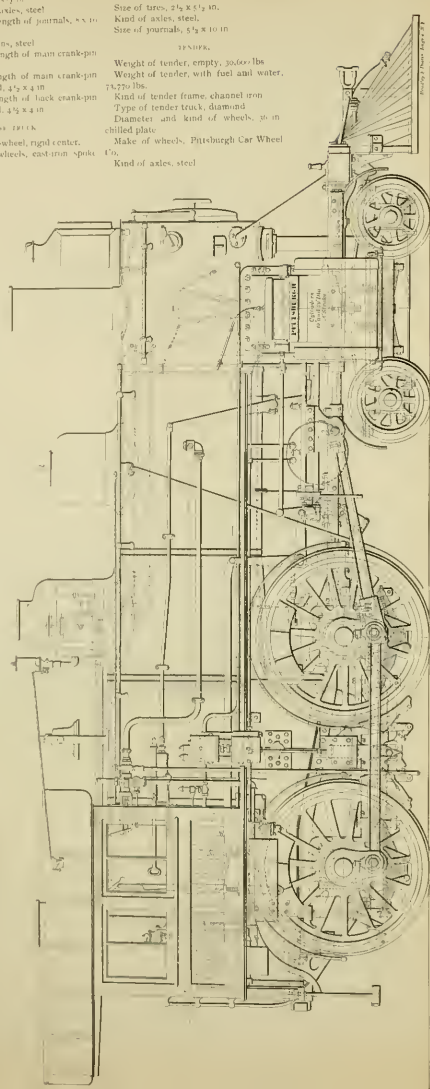
Kind of tender frame, channel iron

Type of tender truck, diamond

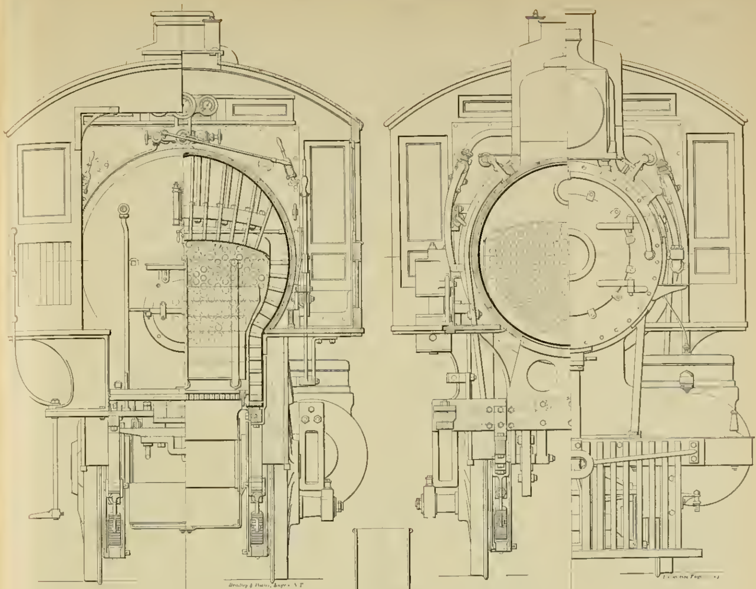
Diameter and kind of wheels, 36 in. chilled plate

Make of wheels, Pittsburgh Car Wheel Co.

Kind of axles, steel



PITTSBURGH COMPOUND PASSENGER LOCOMOTIVE, EXHIBITED AT WORLD'S FAIR.



Rear Elevation. Section Through Firebox. Section Through Guides, Looking Back. Front Elevation.

Size of journals, 4½ x 8 in.

Capacity of tank, 3,500 U. S. gallons.

Tender brake-beams, Schoen pressed steel.

Tender brake heads and shoes, Christie.

PRINCIPAL FEATURES.

Guides, steel, Laird type.

Cross-heads, cast-steel, with brass gibs, Laird type.

Connecting-rods, steel.

Type of rods, "I" section, parallel rods with solid ends.

Pilot, oak, with wrought iron bull-nose.

Lagging on boiler, cylinders and dome, wood.

Jacket, planished iron.

Cylinder-head casings, pressed steel.

Steam-chest casings, pressed steel.

Dome top casings, pressed steel.

Sand-box top and lid, pressed steel.

Smokebox front and door, pressed steel.

FITTINGS.

Type of brakes, Westinghouse automatic.

Train signal, Westinghouse.

Brake shoes, Ross Meehan.

Make of injectors, Monitor.

Size of injectors, No. 9 right side, No. 8 left side.

Safety-valves, Crosby.

Whistle, Crosby Chime.

Steam-gauge, Ashcroft.

Head-lamp, Williams.

Lubricator, No. 9 Nathan.

Metallic packing, Jerome.

Engine and tender springs, A. French Spring Co., Ltd.

CAPACITY OF THE ENGINE.

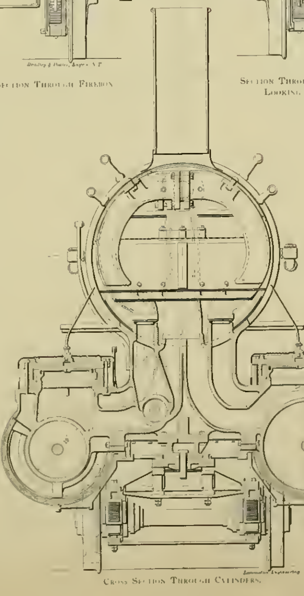
The makers state the net hauling capacity of the engine in tons of 2,000 pounds, as follows:

At 40 miles per hour.

Level					450 tons
¼ % grade, or	13.2	feet	per mile,	315	"
½ %	"	26.4	"	"	235 "
¾ %	"	39.6	"	"	180 "
1 %	"	52.8	"	"	140 "

At 20 miles per hour.

1¼ % grade, or	66	feet	per mile,	310	tons
1½ %	"	79.2	"	"	260 "
1¾ %	"	92.4	"	"	215 "
2 %	"	105.6	"	"	185 "
2½ %	"	132	"	"	140 "



Cross Section Through Cylinders.

Superfluous Information.

There is a railway station in Glasgow called Maryhill! The name made a poor Irishman the laughingstock of his friends in the early days of railroading. The railway had not long been in operation when Pat wanted to take a ride on the train to experiment on how it would feel. He was perfectly at sea about how to proceed to obtain permission to board the cars, but he determined to watch others. Placing himself at the entrance to the platform near the ticket-office window, he waited to hear what the first intending passenger would say. This turned out to be a woman, who said, "Maryhill, single."

Pat had now learned what to say, and he boldly walked up to the window and shouted, "Patrick Murphy, married, wan wife and two childer."

The flue-sheet strengthening device illustrated in the January issue of this paper was designed by Mr. James Hughes, foreman boiler-maker for the D., L. & W. Railway at Scranton, Pa. Mr. Hughes has applied for a patent on the device.

Discipline Without Punishment.

By Geo. R. Brown.*

The usual penalty for a serious violation of rules on American railroads is dismissal from the service. Minor infractions are usually punished by depriving the offender of employment for a fixed time, ten, thirty or sixty days—few roads have adopted the European practice of direct fines. In my estimation, as a rule, these forms of punishment are as unjust and inhuman as they are unnecessary.

It is a well understood principle in jurisprudence that a law without a penalty for its violation partakes more of the nature of advice than of a law.

The rules and regulations governing the running of trains on a railroad are laws, and should be so considered, and penalties for their violation are not wanting.

The responsible officer or officers of a railroad must act as judges, try every case, make every decision and punish every violator. It is not only their right but their duty, to be strict in maintaining discipline. They have no right to excuse one offender and punish another, but must try every case on the calendar.

Penalties are imposed for two purposes. First, to uphold the law and prevent its further violation, and, second, to reform the violator.

Punishment inflicted indirectly benefits thousands who do not violate the law as well as the one who does.

It often occurs that the disgrace and misery occasioned by a strict enforcement of a sentence does more to ruin the guilty than anything else, and a wise provision has been made allowing courts to use their judgment as to carrying out punishments, this is known as "suspending sentence." If the some-time offender does better, and is not guilty of the same or other offenses, the judge conveniently forgets the indictment hanging over him, but should he go on committing one misdemeanor after another, his "record" rises up to condemn him.

I believe in and practice "suspending sentence" with railroad employes.

Officers of railroads differ from judges of the law in that they *make* the law and enforce it, while the judge administers the law as he finds it. If the people are dissatisfied with the laws they change them, but there is no appeal from the decision of the railway official, who performs the functions of judge, jury, executioner.

Railroad officers who hire, discipline and discharge employés cannot be too careful in exercising their authority, and no honest one can afford to decide on a single case without first "putting himself in the other man's place." In other words, treat him as he himself would consider just and honorable if the sentence was to be pronounced on him, and the decision should be made impassionately, impartially, and giving him the benefit of all doubts.

Accidents have happened on railroads since the starting of the "Puffing Billy" until to-day, and are likely to happen as long as railroads are operated.

Every wreck, every accident, every mistake, every loss has taught its lesson, and these are of no less value to the railroads and to railroad men than the successes. I practice making every mishap a lesson to every man on the road.

It often happens that an accident or a "close shave" for one is the best kind of a lesson to the man who could be blamed, and, if he is retained in the service, he is a more valuable man than he would otherwise be or who could be hired to take his place.

I am afaid that it would do me no good, and would do me harm, to lay me off for thirty days for any offense, and I am sure I would do no better when reinstated than if I had been allowed to continue in the service. I should feel as if I had been ill-treated, as if my family had been deprived of the necessaries and comforts that my earnings afford them, and that they were the innocent victims of an injustice.

In order to make every accident and incident happening on the road a lesson to all the trainmen, I established, ten or twelve years ago, what I call a Miscellaneous Bulletin Board.

On this we post up brief accounts of mishaps and other occurrences on the line pointing out how such trouble could be avoided, etc. This board is closely scrutinized. We do not mention names, but, of course, the men know "who's who" in most cases. This board has done much to keep the men on their guard, prevented many accidents, and shows them how headquarters look at every case, instead of letting them discuss every accident around the roundhouse and caboose stoves and form their own conclusions—no two of which will be alike.

To show the class of notices posted, I inclose a few that have appeared. We usually leave a notice up for ten days.

Too much coal is frequently put on locomotives, so much so, that when running along the road more or less of it jars off over the sides of the tank.

Engineers, please correct this in future by not taking so much.

Flags used on locomoves and cabooses in many cases are badly faded. In some cases, the faded green flags look very much like dirty white ones. When flags are dirty or faded, new flags must be procured in their places.

Conductors and engineers, please give this your careful attention, remembering that the safety of employés and trains largely depend upon it.

I am credibly informed that engineers, more particularly passenger, find fault with flagmen on account of being flagged, even when it is absolutely necessary that the train should be stopped.

If engineers have any criticisms to make about when they should or should not be flagged, they will please make them at the office, and not take the matter up with the flagmen personally.

Engines Nos. 6 and 21 collided near the water-tank in shop yard, damage, about $80. No. 21 was going to the shops after coming in on passenger train. When the yard engine first saw No. 21 they were in one of the shop tracks, and should have remained there until No. 21 passed. Instead of doing this, they backed out on the main track, and continued to back until they saw that No. 21 was not liable to stop.

Yard engines must under *no* circumstances detain road engines going to or from the shops or their trains.

There is little doubt but what engine No. 21 was making too high speed around the curve, and both engineers are more or less to blame, but particularly the engineer on engine No. 6.

Train No. 9 on Decoration Day, May 30, collected twenty-nine passes, twenty-five of them from Corning; train No. 6, on the same day, collected fifty-seven passes, fifty-five of them from Corning.

These trains were crowded with passengers all day, and many of them were obliged to stand up. The conductors had frequently to call the attention of the persons holding passes to the fact that paying passengers should have seats in preference to dead-heads, and in some cases persons holding passes were quite indignant because the conductor so requested them.

The number of passes given are not restricted as much as they should be and particularly on legal holidays, when, as a rule, our coaches are filled with persons holding tickets.

Investigating, I find that a large number of these passes were given to persons who had no particular business, any more than to have a ride because it would not cost them anything.

Officers will please continue to follow the pass business up very closely, and not grant passes unless you think employés have some business or reasonable excuse for desiring to go. On legal holidays you will restrict them entirely.

A coal train arrived at the "Y" without any man on the rear end. Investigating, we find that the conductor went over to the engine at Angus; a brakeman got off at Angus to close the switch and he claims the train ran so fast he could not overhaul it, the flagman got off at Earles to close the switch, and he also claims the train was moving so fast he could not overtake it. There was, therefore, no man on the rear end of the train from Earles to the "Y." Had the train been obliged to stop, no flag would have been sent out, and had it broken in two there would have been no one to control it or prevent a wreck.

1st. The conductor had no business that required him to be on the locomotive.

2d. The engineer should not have left Angus for Earles until he got a signal from a man standing on the rear cars and not on the ground. The flagman should have given a signal to stop the train until the brakeman overhauled it at Angus.

Nothwithstanding there is a telegraph office at Earles, not one of these men reported this occurrence to Corning office or to the following train, which shows lack of judgment on their part. Fortunately nothing unusual occurred to cause a wreck.

Trains Nos. 21 and 25 were at Lawrenceville. Train No. 25 occupied the track next to the station, and when they left they pulled through the Tioga cross over on to the F. B. main track.

One of the men from train No. 21 was standing on the F. B. main track south of Tioga crossover, and as rear end of train No. 25 passed flagman asked him to close the switch, and he consented to do so, jumping on the rear end of the caboose and riding to F. B. switch, and claimed to know nothing about the Tioga crossover being wrong. When the Tioga train arrived they ran one car off the end of the track.

The conductor and flagman of train No. 25 claim they expected him to close both switches, and the man from No. 21 understood he was only to close the one.

This conclusively shows that it is best for the men on every train to close their own switches, and will please do so in future.

A south-bound coal train overtook the way freight at Reading Center, and was nearly stopped when the way freight started. After the way freight passed the station the semaphore was raised, and the engineer of the coal train pulled slowly by the depot the engine and several car lengths and within six or eight rods on the caboose of the freight.

Two ladies attempted to cross the track after the freight passed and their horse was scared, and were unable to do so. They were turned around in the street, and a man caught the horse before any damage was done. The engine of the coal train was behind the depot where the ladies could not see it, and they claim they understood that trains were to run *five* minutes apart. This is correct, and should have been done. We learn from this:

1st. That the way freight is holding coal trains, which is prohibited.

2d. That trains are following each other too closely, which is prohibited.

3d. That this train passed the semaphore when it was up, which is prohibited.

Under *no* circumstances must the pilot of a locomotive pass the semaphore pole until the blade is dropped.

A north-bound train had some cars derailed at the south end of Level Corners' siding about 5.17 A. M. The cars ran up the main track far enough so that trains could have passed through the side track had not the frog been injured. The trainmen reported that it was necessary for a wrecking crew, which we ordered of the Beech Creek Co. Instead of taking their engine and going to the section house near Larry's Creek, getting the sectionmen out and telling them what was required to make the side track ready for passing trains, they remained at the wreck, and the wrecking train had orders to stop and get the sectionmen where they found them surfacing the track, at nearly 8 o'clock in the morning. When they arrived at the wreck they had to go back to the toolhouse for the necessary material and tools to take out the frog and put in a piece of rail—and it was about *five hours* after the derailment before trains could pass. Had they taken their engine and went immediately for the sectionmen the track could have been made ready in not to exceed one and a half hours, thereby saving delay to all other trains of at least three and a half hours.

Conductors and engineers should always look the situation over carefully and work with a view of getting trains around the wreck at the earliest possible moment, leaving the wreck to be cleaned up later on.

Train No. 82 whistled for and received the signal at Slate Run and passed on time. The operator fell asleep and neglected to raise it. The conductor of train No. 82 neglected to see whether it was raised or not, and neglected to report this fact at the next telegraph office, as the rules require.

Train No. 66 was the next train to pass there, and did pass without seeing the semaphore blade lowered. Conductor of No. 66 also passed there without seeing it raised or reporting this fact at the next telegraph office. When the dispatchers asked the operator for train No. 66, he did not know whether it had passed or not, as his semaphore had not been raised after train No. 82 passed. The rules require that under no circumstances must a train pass a telegraph office until they know the semaphore has been lowered after they whistled for it, and also requires every conductor to see it raised after his train is passed, and if not done, to report it from the next telegraph office.

You will doubtless remember that some time ago a similar circumstance occurred at Blackwells, and it came very near causing a head-end collision. Notwithstanding this, these men deliberately violated the rules, and took the chances of their own lives and the lives of their fellow employés. Fortunately, no accident occurred; but these men are each held personally responsible for the violation of rules, and a similar occurrence will cause their prompt and permanent dismissal from the service of the company.

A brakeman was posted to go on train No. 85. Instead of going, he arranged with another who was not an employé of the company to go in his place, without permission from the office. When called in the office to explain he said he had been here about two years and did not know that he had to get permission under these circumstances.

For the information of all other brakemen will say, that the man who went in his place will not receive any pay for the trip, as he was not employed by the company to perform such service, and the brakeman who was posted has been discharged for this and other offences.

The conductor is not responsible, for he supposed this man was an extra man until going down Pine Creek, he asked him his name, at which time he asked the conductor to put the other man's name on the time-slip and he would get his pay from him, as the other man had been here about two years and was entitled to $1.75, where he would receive only $1.62½. The company does not allow this kind of financiering.

If we have any more brakemen who are so ignorant of the rules, and do not know they must receive permission from the office when they desire to lay off or procure a man in their place, it is high time that they do know it, and this notice is posted for their information.

A train derailed a car one and one-half miles north of Tioga. The conductor came to Tioga at 9.40 A. M., and reported he thought he could clear the track in an hour. He went back to the wreck and did not show up again until 12.15, at which time the track was clear. This was one hour and thirty minutes after No. 4's time at Tioga, he holding them there by flag. Had he said at 10.30 that he would hold No. 4, we could have run them through the Coke Works and over the Tioga road, and get them to Corning nearly on time. We finally ran train No. 4 through the Coke Works, making them one hour and thirty minutes late at Corning. No. 1 was also held forty minutes at Lawrenceville before we ran them via Coke Works, and the conductor is responsible for this delay. Some trainmen seem to have the impression that there is no other train on the road but theirs.

A loose wheel derailed a north-bound train taking the side track at Blackwell's. Train No. 1 was detained fifty minutes on account of 4th 70 pulling around the wreck through the short side-track just below the station. They stalled in this short side-track, and instead of cutting a part of their train off and putting it in the north-end of the passing track and then going back and getting the balance of it and letting train No. 1 out about on time, they continued to try to pull the entire train at once, and with the above results.

This is very, very bad judgment on the part of the conductor and engineer.

We don't always give the boys left-handed compliments. Here is a right-handed one from a farmer.

WEDGEWOOD, N. Y., July 31, 1893.

MR. G. R. BROWN, *Gen'l Supt.*,
CORNING, N. Y.

DEAR SIR—Yesterday morning as train No. 85, drawn by engine 56, was approaching this station, your employés on same discovered a portion of a flock of sheep on the track, and instead of dashing into and over them, by which a number of them must have been killed, they slowed down

*General Superintendent of the Fall Brook Railway.

and used all their efforts, and so managed that not a sheep was injured. I mention this, deeming it worthy of your notice, that the men on engine No. 56 and train No. 85 should receive your commendation as making the extra effort in the interest of your company, even if in the line of duty.

We put up a notice that at the end of the year, we will pay a cash premium of $60 to every freight conductor whose services have been *entirely* satisfactory. It speaks well for the men when our report shows that forty-five out of fifty-six conductors were awarded premiums. The reasons the other eleven failed are given below, which shows that some of them lost it through no fault of their service.

1. Brought car of freight Newberry Junction to Corning as an empty car.
2. Absent on vacation about half a year.
3. Stood in Billsboro side track to switch car in spur, set one brake back of car to be switched. Rear end ran down and collided with car going in spur.
4. Only worked part of year; resigned.
5. High speed Beaver Dams to Watkins, and from Log City to Long Point.
6. Violation of rules. He supposed engineer had sent a flagman.
7. Put two cars off end of side track at Dresden by giving back-up signal without receiving same from the man on rear end of the train. Broke telegraph wires. Did not report it until next day.
8. Ran double-header to Beaver Dams, and only took cars that one engine should haul. (Since discharged for drinking. Now proprietor of saloon in Corning.)
9. Allowed 3d 70 to pass Cooks less than ten minutes behind, the second section overtook them south of Presho and collided.
10. Left car of horses at Himrods Junction that were slipped for Watkins. Man in charge told him it was an error on bill. Settled difference in freight, $4.50, besides losing premium.
11. Engine "John" (pony engine used by officers of company) found train south of Earles; his flagman not out proper distance; conductor in caboose and could see flagman plainly.

We also pay premiums to section foremen for best kept track.

For the trainmen we keep a record-book. This book is never shown to any employé, except that page which is his personal record.

In it I write down a brief statement of every irregularity for which a man is responsible, this record takes the place of the "lay off," and is dreaded fully as much; the man goes to work at once and no one but himself suffers, and he only in reputation at headquarters.

We are very careful in the selection of our men, promote all our own engineers and conductors, and in a few months or a year or two our record tells us whether they are "adapted for the business" or not.

We have engineers who have been running here more than twenty-five years, without a scratch of the pen against them; while others, who have been running as many months, have quite a page full of irregular "circumstances;" but down near the bottom of such a page can generally be found the word "discharged"—incompetent.

When a man commences to "make a record" (in the book), we call him in and talk with him. He is reminded that, if this gets too long, we shall have to consider him a failure for our service, show him his weakness—if we know it—and give him another chance. But he understands that it will not be entirely for the last offense that he is dismissed—the "suspended sentence" cases are against him.

With this system the good men are retained, developed, benefited and encouraged and the culls are got rid of to the betterment of the service all around.

It is well understood that we do not wish to retain in the service men who deliberately deceive us about mishaps on the road; we want the "straight" of every matter and we want it at first hands. It would be a very lively spotter who could get to my office sooner than some of the men who are responsible for accidents. If it is not serious enough for dismissal the matter is overlooked or made a matter of record, and the man goes out on his regular run. Then the "Miscellaneous Board" has another object lesson on it.

If there is anything that will stimulate a good man, who has become careless enough to make a lapse of duty that "gets him in the book," more than that simple record, I do not know what it is. They beg not to be "put on record," but when the record is made and the victim warned to look out and attend to business in future, and to take his run out in the morning, he goes away with a mental vow not to be caught again—and some of the records are years apart. In some cases one memorandum is made, and never an occasion given for a second one.

Good men who have made some little mistake, are less likely to do so again, than men who have not yet tried the responsibilities of running trains and engines, or men who are not familiar with our road or work. If the responsible officer takes such an offender into his office, talks the matter over dispassionately and tells him that he is considered too good a man to be discharged for incompetency, that the accident has cost so much, which the company will stand "this time," but perhaps not the next, and tells him to "go and sin no more," this has a tendency to make better and more successful railroad men of the ones that are naturally adapted to railroad work—and the "next time" comes only too soon to the man out of his sphere.

There is nothing in this to disgrace him among his fellows, nothing to make him feel revengeful or maltreated; but everything to make him feel as though he was encouraged and helped, and that his final success depended solely upon himself. Can as much be said of the plan that disgraces a man among his fellows, that takes the comforts and, perhaps, the necessaries from his home, that makes him a loafer for thirty or sixty days and puts him in the way of temptations that he would not find at his work, and that leaves him, in many cases in debt to the dealers who furnish his family supplies?

On many roads there is a great want of cordiality or confidence between the men and the officials immediately over them. In too many cases a suggestion from a trainman to an officer would be resented as an unwarranted interference. It seems to me this is not in the interest of the railroad company, however much it may enhance the dignity of the official—who is himself only "one of the hired hands," with a little more responsibility.

I have found suggestions from the men of vital importance in matters of detail, and every man in the service knows that the rule and motto at headquarters is, "Suggestions are Always in Order."

Train and enginemen see and know things about the road that an operative officer could never find out in his office. At their suggestion, we have frequently made minor changes in time-table, etc., and every change has been an improvement. The humblest man on a section may suggest something that will save the company hundreds of dollars, and besides this encourages men to think and become more interested in their work, and feel at liberty to modestly offer other suggestions.

When a suggestion is made that is considered impractical the reason that it is so pointed out, and both the man and the manager have learned something. I am sure this rule makes and keeps up a friendly feeling between the men who plan the work and those who execute it.

Roads that can afford to let one department fight another, who can afford to have hundreds of employés disinterested and dissatisfied with their work, who can afford to have the officers "out" with the men, and the men glad to see any hoped-for improvement a failure, are few and far between.

The suggestions set forth in this article may not be practicable everywhere, but on a moderate sized road (Fall Brook has 257 miles all single track, with an average tonnage of about 6,000,000 yearly) where the superintendent knows all the men, or most of them, it has worked so well for years that I have an abiding faith that it will work anywhere, and in every case in the interest of better service.

Wanted—A Railroad.

On this page we publish a view of a train on the Humboldt Logging Railway, in Humboldt Co., Cal. Humboldt is one of California's northern coast counties, and is walled of from the rest of the State by the Coast Range Mountains. Communication with the outside world is mainly by water.

TRAIN OF REDWOOD, ON THE HUMBOLDT LOGGING RAILWAY, CALIFORNIA.

The Humboldt Logging Railway is owned by the Excelsior Redwood Co. The road is operated only in summer, and hauls from 20,000,000 to 30,000,000 feet of logs, besides, 5,000 or 6,000 cords of shingles and shake bolts, piles, and other such material. The load shown in the picture is not an unusual one, but just an every-day load. The road is only ten miles long, and runs from Humboldt Bay, along Freshwater Creek into the forest. The redwoods of this region are giants and the scenery correspondingly grand.

There are nine or ten such logging roads, standard gauge and well-equipped, but only one passenger road, the Eureka & Eel River Railway.

The one thing lacking to the development of one of the richest counties in a rich State is railroad communication with the commercial world.

Are you taking an interest in our prize designs? Someone is going to get some money for an idea or two—it might be you.

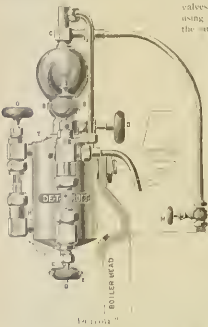
Brooks' people have received an order from the Lake Shore for ten locomotives.

Sight-Feed Lubricators.

How to Set Up and Run Them—A Description of Those Most in Use.

There are two things now in common use that have made a revolution in locomotives, and in the handling of them, within the past twenty years, and yet we believe these two devices are less understood by the men who handle them than any other thing about the locomotive: we refer to sight feed lubricators and injectors.

Much has been written and much has been said about injectors, but you scarcely ever see anything in print about lubrica-



"Detroit."

[illegible] road is building engines [illegible] using these devices.

There seems to be just as much want of [illegible] among the men who put these [illegible] up as those who run them.

There is nothing mysterious about the working of either of them, and when the principle is understood defects and peculiarities are easily detected and remedied.

Some years ago the writer got on to a new locomotive for a ride and noticed that a fine, nickel plated Detroit cup was empty, and that at every shut-off the fireman oiled the valves through the old cups that had been left in and the pipe connected through them. On inquiry it was found that this was the first cup the road had got, that it "wan't no good" and was going to be "took off."

A little personal experience with this cup had proved that it would work if given a show, so the engineer was asked how it worked.

"Well, it feeds all right for about half an hour, then the glass all fills up with oil and it won't feed." That description made the trouble perfectly plain, the hand oil-cups, on the old style lubricator were valves that shut off connection to the top of the glass, or feed-arm, and they had tried to run the cup with these shut, the cup fed until the cavity above the glass was filled with oil, then it filled the glass. He filled the cup then and there, it worked and it was not taken off.

Now the engineer, fireman and traveling engineer had all labored with that cup and couldn't make it work, and there was a card of directions tacked to the cover of the engineer's seat-box, too. Engineers and firemen are constantly asking such questions as

"Can't both feeds go to one cylinder cross-feed?"

"You can't tell but what the feed is goin' into the boiler, can you?"

"What's in the oil pipe to the chest, oil, or water, or steam?"

"How can the oil go from the cup to the cylinder against the steam pressure?"

There are many kinds of sight-feed lubricators, up-feeds and down-feeds, sprays, flashes, etc., but they are in use on stationary engines. There are only two lubricators for locomotives that amount to much or that are well or generally known—the "Detroit" and the "Nathan."

Both of these instruments use the Gates foundation invention of the up-feed, a drop of oil arising by virtue of its specific gravity through a glass tube of water.

Both of these lubricators feed oil to the valves and pistons whether the engine is using steam or not. Both require about the same handling to successfully operate, and so we will ignore all other makes and consider only these two.

SETTING UP.

There is little or no difference in the way these two makes of lubricators should be put up in the cab. It is of the first importance that the following instructions are carried out:

1. Support lubricator with a heavy bracket (at least 2 x 1 inch), preferably in the center and on top of the boiler.

2. Connect the top of the steam dome, or condensing chamber, to the dome or the turret direct to boiler is best. For this use dry steam space in the boiler, good ¾-inch copper pipe and a good globe valve, and be sure you place this next to boiler; if there is considerable pipe between steam supply and the valve it may get broken off some day and kill somebody. The Detroit company insist that this pipe shall be lower at all points than its connection to the cup. This drains the surplus condensation back to the boiler, allows dry steam to pass through the equalizing pipes, and secures a uniform feed.

3. Connect the regular tallow, or oil pipes to the union couplings on the fitting above the feed glasses.

4. Be sure you take the valves out of the oil pipe connections over the steam chests. *This is very important.*

Whatever cup you have, if it is put up neatly this way it will work if properly handled.

TO OPERATE.

1. Fill the cup with oil, through the filling plug in front—and be sure you strain the oil; a very small piece of waste, stick or other foreign matter will stop up the feed.

2. Open steam-valve, admitting steam to the dome for condensation. It is always best to fill the cup when the engine goes in or at the end of the trip, then open steam-valve before the engine is taken from the house at all; or if the cup is empty close water-valve at back and open steam valve: this allows for condensation and the glasses are full of water.

3. *Never* open feed-valves below the glasses unless the glass is full of water.

4. On the back of each cup, just over the supporting stud, there is a valve, known as the water valve; this admits water from the condensing chamber to the bottom of the cup; open this after the glasses are full of water and before you want to start your feed.

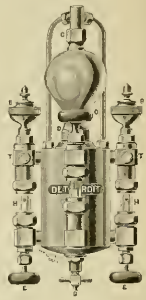
5. Open feed-valves below the glasses, admitting the number of drops per minute that has been found necessary for your work. A large engine requires more oil than a small one, and where there is bad water and foaming or priming in consequence, more oil will be needed.

6. To stop the feed, close the valves below the glasses—leave all the others alone.

7. To refill the cup, close that water-valve at the back, this shuts off the supply of pressure from the lower part of cup; then close your feed-valves below the glasses and draw off the water at plug below the cup. It is best to draw this into a cup, as where a pipe is connected it is hard to tell when the water is all out and good oil running to waste.

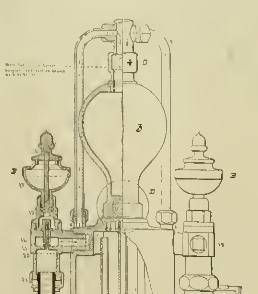
8. Just as soon as you fill the cup and replace the filling plug, open the water valve, *whether you want to start the feed or not.*

9. In the "Nathan" never close the valves on top of the glass gauges, *except* when a glass breaks; then close the one over the broken glass, and the feed valve under it, and use the hand oil cup for that side of the engine—this in no way interferes with the feeds of the rest of the cup, be there one or two. In the "Detroit" there are check-valves over the glasses, so that when one breaks the top connection is automatically closed, and it is only necessary to close the feed-valve. Use the hand cup for that side. These valves also protect the tops of the glasses, prevent their cutting away and breakage. As these valves are always working in oil, they will not lime up, and will positively close in case of breakage of glass.

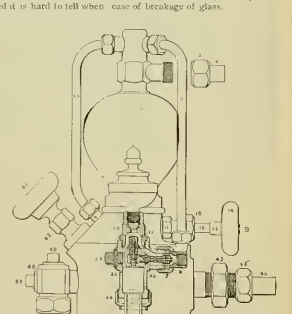


"Detroit" No. 2 Front View.

10. Always carry extra glasses and gaskets. To replace a glass, first shut off the steam from the cup altogether. Close the water-valve at rear. If it is a

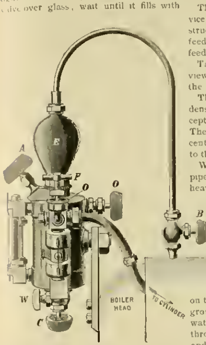


Sectional Front View "Detroit."



Sectional Side View "Detroit" No. 3.

"Nathan," unscrew the packing-nuts on the broken glass, knock it out, and if you are on the road put the nuts in a pail of water to cool them off. Take a wrench and unscrew the *box* of the valve *on top* of gauge glass, and drop the glass in from the top, hold it partly up, slip on a new gasket, then the upper nut (notice that threads are *up*), then the lower nut, another gasket, and drop the glass into lower fitting. Replace the valve and box and tighten up the packing-nuts—not too tight at first. Open water-valve and valve over glass, wait until it fills with



"NATHAN"

water, then open the feed. If the cup is a "Detroit," shut it off from the boiler and close the water-valve at back and the feed-valve, take off packing-nuts same as before, and then with a wrench take out the *feed-valve box* and put glass in from the bottom, get the nuts and gaskets on right and replace valve, proceeding as before.

11. Always clean the lubricator at least once in two weeks. Do this by opening every valve in it wide open, except the filling plug, and then turn on steam.

12. Don't try to put in a glass running. The cup is hot, the jar prevents your handling such small work, you may drop and lose some of the parts, it takes your attention from your regular duties—and the hand-oiler is all right anyway. *Don't monkey with old gaskets.*

POINTERS.

Both kinds of lubricators are made of bronze or gun metal and are tested to about 300 pounds, yet we often see them badly bulged—this is because a careless or ignorant man has not followed instructions. If the steam connection and the water valve are opened after filling, the cup can never get more than boiler pressure on it; but if cool oil is put in until it runs over and left bottled up, it will expand when it gets hot and it will burst the cup if it can't bulge and stretch it enough to take care of the expansion.

When you see glasses all oil inside, with the feed going up along the glass, you may know that the man who started it did not wait until the glass was full of water.

Some prefer to take the live steam directly from the boiler, as the pressure is more constant than from a fountain or turret, but under ordinary circumstances the feed will be constant under any handling of the throttle.

Cylinder lubricators were not successful until a spray of live steam was introduced into the oil-pipe beyond the feed-nozzle, this carries the oil to every part of the chests and cylinder.

When the drop of oil "squats" on the nipple in the feed-glass, gets very large and seems slow to go up, often taking the side of the glass, it shows that the oil is too near the specific gravity of the water—too heavy. A little black engine-oil will remedy this.

Where very light-colored oil or tallow is used, it's a good plan to put in just enough black oil to darken it. The drop can be seen much better, especially at night.

To those who are interested in *how* a thing is done, the following description of the two kinds of lubricators will be valuable.

THE "DETROIT."

The numerous illustrations of this device here given will make plain the construction of both kinds, the one simply feeding each cylinder, and the one also feeding oil to the air pump.

Take the No. 2, and in the front and side views any one may become familiar with the construction.

There is no connection between the condensing chamber and the oil reservoir except through the water-valve shown at *D*. The pipe admitting water is shown in the center of the front view, reaching almost to the bottom.

When a drop of water goes down this pipe it displaces a drop of oil, water being heavier than oil, it remains at the bottom, and as there is no other means of escape, the drop of oil must go down one of the oil tubes—the curved pipes shown on either side—practically there is a pressure of oil in these all the time which the feed-valves below the glasses regulates.

When the oil drop appears on top of the nipple in the glass and slowly grows in size until its bulk displaces enough water, it is pulled off the nipple and arises through the glass, lifts the little check-valve and passes through another nipple, this nipple is surrounded by steam escaping from the top connections of the condensing chamber, and is carried to the chest and cylinders.

In this lubricator the connection to the boiler is below the connection of the equalizing tubes, and the makers claim an advantage here, as nothing but live steam can pass through the equalizing tubes. Water stands in the chamber up to the steam connection.

The hand oilers are connected by passages *around* the check valves, so that when the cup is shut off or broken these can be used at any time by simply closing the throttle.

The No. 3 device is just like the No. 2, except that in place of a tube in front to show the level of the oil in the cup, there is a sight-feed glass here that supplies the air pump. There is a bridge right across the cup, and the feed-pipe connection is through the stud that supports the cup, as shown in the cut.

The way all these passages are made is plainly shown in the detailed drawings.

THE "NATHAN"

has its equalizing tubes inside the condensing chamber, and the water level here is up to the small perforations in these pipes, as shown in the front view of the lubricator, and the passages down these tubes and past the top valve of the glass and around the upper nipple is plainly shown in the right hand cut of the plan view—which shows a cup cut through the top bracket horizontally.

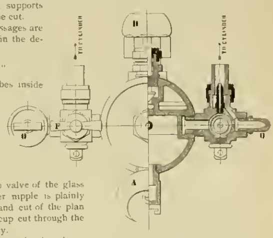
The passage from the condensing chamber to the cup through the water-valve is shown in the side view. All pipes and passages in this lubricator are straight and have plugs opposite them, so that they may be cleaned or inspected.

Only one oil pipe is used, but this is in the center of the oil cup and fills a cross passage at the bottom that supplies oil to both feed valves.

Oil passing up through the glass does not have to lift a check, but has an uninterrupted passage to the upper nozzle.

The hand oilers are entirely independent of the cups. Shut the throttle and use them same as the old oilers.

When an extra feed-glass for the oil pump is used on the "Nathan," the glass is put on the side of one of the regular feed-glasses and the oil passage at bottom is extended to it. This leaves the gauge-glass in front intact.

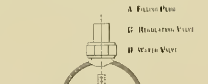


PLAN. "NATHAN"

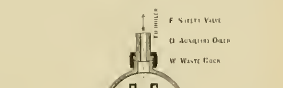
Where They Get Left.

There have been a great many claims made lately that the stockholders of the New York, Pennsylvania & Ohio are suffering injustice at the hands of the Erie, and that efforts will be made to have the property returned to the owners. If among those who are howling in favor of independence there is one with real property interests in the N. Y. P & O., we expect he is like the valiant Roman who was spoiling for a fight and called out, "Howld me, Barney, or I'll hit some one wi' me shaleelah!" They are screaming fight in hopes of gaining some advantage from their valiant bearing, but they would be all broken up if the Erie company should take them at their word. A much better railroad could be built through the route of the N. Y. P. & O. at one-third its cost. The assertion is made and reiterated that the Erie is letting the N. Y. P. & O rolling stock run down, but every practical man who is familiar with the plant knows that it never was in better condition.

The New York, Ontario & Western have placed an order with the Peninsular Car Co. for 500 coal cars. They will be equipped with Gould couplers and Schoen pressed steel center plates.



SECTIONAL SIDE VIEW "NATHAN"



SECTIONAL FRONT VIEW. "NATHAN."

LOCOMOTIVE ENGINEERING
A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER and ROLLING STOCK

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Two Kinds of Railroad Management—Is the New an Improvement?

Consolidation and combination, and pool and trust and combine are in the air. In no business has consolidation reached such proportions as in the railways of the country, and with this substituting of one great corporation for many lesser ones has come a consolidation of offices and the lessening of direct personal supervision, for the very thinly-covered management of a few blanket officials is spread out so thin that they cannot be seen.

In the days gone by, when a railroad with a thousand miles of track was a pretty good sized railroad, there arose for the places many railroad officers especially fitted to manage these lines of transportation—men who had the training, the experience and the grasp of detail that made them able to successfully handle the property intrusted to their care.

These men "had all the say," were just and honest, and managed the railroad property in their hands just as if it was their own—to make it pay.

The great corporations have been of comparatively slow growth, yet before the manager, who finally "came out on top," knew what had happened, he had a white elephant on his hands.

There was more work than any living man could do and do right, and this detail and that detail was lost sight of or given over to the care of some subordinate, and the new general manager of the great road dealt only in "glittering generalities."

A very successful manager once said, in reply to a question about the foundation of his success, "I look after the pennies."

That explained the whole thing—grasp of detail. No man has yet been born who can manage a 10,000-mile road half as well as a thousand other men can manage a 500-mile road.

But there are other things that have worked to make so many of our roads "no-dividend" lines or put them into the hands of receivers. Perhaps a few extracts from a private letter from one of the ablest and best railroad managers in this country will make our meaning clearer than we can:

* * * I note all you say about the condition of our railroads. Many of them are in desperate straits, no doubt, and if the pressure of hard times continues for another six months as it has in the past six, many more of our great consolidated railroads and manufacturing concerns will have to succumb to the inevitable and go into the hands of receivers.

I agree with you thoroughly as to the cause of much of this trouble. One of the greatest mistakes has been the consolidation of so many lines into great systems and the putting of their management into the hands of comparatively few officers.

How much better our roads were managed when they were comparatively short lines, operated by "railroad men" who knew every man on the road, and were familiar with all the details of operation and the duties of every employé.

The successful operation of any line of road requires the constant and intelligent personal supervision of trained and experienced officers in all departments, all of them working under the general supervision of honest, capable and intelligent general officers, who devote their entire time to the property under their control.

Too many railroads are managed by broken-down merchants and lawyers as presidents, who haven't a single idea of the details of railroad work. They spend most of their time riding about the country in private cars, and in figuring how they can best serve their own personal interests at the expense of the railroad company.

Nowadays there are too few Allan Manvels, Hugh Riddles and Marvin Hughitts, and many similar men, who had the knowledge enabling them to handle every detail and the ability to select suitable men for their assistants, who are able to manage and control property.

The life blood of many, I might say most, of our great railroad systems is being drained by want of experience, good sound *practical* knowledge, and more than all, good 100 per cent *honesty*. There is not enough disposition to work faithfully for the best interest of the companies by the traffic managers and general passenger agents—they are the great men now.

Did you ever think that into the hands of these men, and not the hands of the manager, has been placed the financial interests of the road?

A large share of freight traffic is handled at less than it actually costs to haul it, for the reason that of late years so-called "traffic managers" pretend to know that freight can be hauled at a cost of ¼ of a cent per mile, taken as an average.

Let me cite an instance or two of the decline of rates. During the past sixteen years the Missouri Pacific freight rates, per ton per mile, on a general average, has fallen from 2¼ cents per ton per mile to $\frac{82}{100}$ of a cent, a decrease of 65 per cent in rates, the gross tonnage handled has largely increased without a corresponding increase of earnings. The Santa Fé road shows a similar result. Yet the directors, general managers and presidents seem powerless to remedy these troubles that they know full well are bringing ruin to their roads.

The traffic men of to-day "make a special rate" on nearly every chicken coop shipped over the line—a tariff-book or sheet is of no use to them whatever. It has resolved itself down to a case of getting the freight at any rate the shippers will pay, and piling up the gross tonnage without regard to the cost of handling or net results.

The general passenger department is handled much in the same way, and either position is "worth" more to the occupant than the salary of general manager or president. You hear these things, my boy, and think, perhaps, they are fairy tales or the imagining of diseased minds, but they are not, but stern, cold facts.

Another great trouble is that many of our roads are capitalized for more than twice what they are really worth or could be built for at the present time. In the buying or building of branch lines or feeders (?) and parallel lines, at a low cost and capitalizing them at a large sum per mile with stocks and bonds, and also in consolidating or taking in one-horse roads that never did and never will pay expenses, and issuing watered stock or bonds per mile, large sums of money have been realized by the promotors of these schemes. But the capital of the road is thus increased to such a great extent that it is hard skinning to keep them running, and with increased expenses and a decline of business, such as the present, they can neither pay dividends or interest.

For the past fifteen years I have said, time and time again, that many of our great railroads would, in the end, have to be reorganized, and their immense capital reduced to a limit on which they can safely depend on earning reasonable dividends and interest, or that their stockholders and bondholders would have to wait many long years before they began to realize on their money.

Not one of these great lines is one half officered. Their superintendents and other operative officers are so entangled in such red tape as reports, estimates and statements—trying to make simple railroad problems plain to men who know nothing about the business—that they have very little time to go over their lines and look after their work with that thoughtful and painstaking care that its importance deserves. The general superintendents, general managers and division superintendents have, as a rule, fully twice as much territory as they can give proper attention to. The result is that their work is never more than half done, and what is done is in a hurried, unprofitable and unsatisfactory manner. * * *

The one sole exception of this rule is the Vanderbilt systems. They operate their different roads entirely separate, and if big combinations must come that is the best way to manage them. * * *

There is a good deal of horse-sense in these extracts of a letter from one railroad man to another. The consolidation of a number of railroads under one management is just the same as one pilot trying to steer three ships at once—it can only be done by proxy. The proxy may know where all the rocks *are*, which may be desirable, but the pilot knows where they *are not* which is much more important.

The Slaughter on the Delaware, Lackawanna & Western.

For the first time in many years the D., L. & W. has sustained a frightful wreck of passenger trains.

This road has long been pointed out as an example of how successfully a road may be run on the old plan. The system of protecting trains on the Morris & Essex division, one given up almost entirely to suburban passenger traffic, is just the same as it was in 1839 or 1840—no better, no worse.

Eternal vigilance has been the watchword of operatives, officers and men, and this alone has saved trouble, but sooner or later there is sure to be a failure of one or more human machines, and then disaster is certain.

On the 15th of January, in a dense fog, an express train slowed up to see if the Hackensack River drawbridge was all right and another express train ran into them, killing nine passengers outright, one other dying in a few days and two others beyond recovery, besides over forty badly hurt—some crippled for life.

These trains are due to arrive in Hoboken, opposite New York, just three minutes apart, the head man had lost a little time, the man behind was nearly on time.

The flagman tried to go back, then ran to the cars and tried to get the passengers out, he placed no torpedoes, and used no flag—it is doubtful if a flag or light could have been seen. The engineer of the second train was badly hurt by jumping, and is blamed by the officers of the company.

No one can blame the first engineer for "feeling" for that unprotected draw, the second man had a perfect right to run on time until stopped, except that good judgment might have warned him to caution in the fog; but it must not be forgotten that behind him, only five minutes, was another express thundering across the two unprotected draws and the meadows—to lose much time was to endanger the rear of his own train.

This road runs 160 passenger trains per day into and out of Hoboken station, besides some other trains.

The Lackawanna is a rich road, the Morris & Essex division is a double track line running through Newark and the Oranges, the most populous suburban district around New York. Between Hoboken and Newark, a distance of eight miles, there is a long tunnel, two drawbridges and a grade crossing—the tunnel has some sort of home-made signals, and the grade crossing some wire-handled boards.

Neither drawbridge or the grade crossing are protected by distance and home signals, nor has any one of the three that simple safety device—the derailing switch.

We feel sorry for Superintendent Reasoner, who is being severely criticised, for he has used every precaution to make the Lackawanna system of train running (or rather lack of system) a success, and has succeeded in a great measure. He is not responsible for not providing block signals, he was doing the best he could with what he had to do with. But the world moves, and the old idea of trusting to a rear brakeman to stop the next train has failed again—as it must always fail, sooner or later.

It has long been recognized as true that a *distance* interval between trains—as afforded by the absolute block system—is the best of all known devices for protecting trains. *Time* signals of any and all kinds are mere excuses, as prolific of danger, and more so, than no signals at all.

The best roads in this country have been investing quite extensively in block signals, and it was high time they did. Most of them were forced in the matter, more or less, by serious accidents, but the Lackawanna management has held back and stood out on its past reputation, preferring to render poorer and slower service than its neighbors rather than buy modern appliances.

On many roads a want of money has furnished some excuse for not buying such expensive equipment, but it is well known that the Lackawanna is a prosperous road, earning large dividends, having a large reserve, and their stock selling at 170.

The papers announce that President Sloan says, in effect, that block signals are no better, if as good, as the present system of running trains, *yet they will invest in them right away.*

Block signals would have prevented this accident, and, though the officials may blame the engineer of the second train, the public will not and cannot tolerate any longer the carelessness of human life evinced on this line, by trying to do a heavy passenger business without modern safeguards of approved and tried value. On the management of the company, and on it alone, should fall the blame and the cost of this frightful slaughter. It was as useless as it was deplorable.

Discipline Without Punishment.

We would direct attention to the article on another page from the pen of Mr. Geo. R. Brown, general superintendent of the Fall Brook Railroad.

Mr. Brown is one of a class of managers well nigh extinct—that class who only controlled moderate sized roads, and were personally familiar with every detail and every man—the great systems have done away, in a great measure, with such services, much to their detriment.

Mr. Brown proposes a plan, or rather explains a practice of his in the disciplining of men that deserves more than passing notice from the men in similar positions on other roads.

Has he not offered something better than the general run of treatment—lay off, blacklist, etc.?

If this was a mere suggestion from a

young and inventive officer it might be passed over lightly, but it is not, it is backed by a dozen of years of successful operation—and no railroad man can inspect the Fall Brook road and not notice the excellent service and good discipline.

As the writer's mind went back to the days of his road service, days that occupied much of the railroads' good time in devising punishment by a few officers and resisting it by the grievance committee, he half come to the conclusion that what would do on a little road wouldn't do elsewhere, and that, maybe, there was a screw loose somewhere. He said to himself, you can't change human nature, and railroad human nature expects to be bullied and suspended and discharged without any explanation.

The more he thought of the matter, the firmer was the conviction that human nature was unchangeable, and that perhaps Mr Brown knew better how to handle human nature than other men.

Looking into matters on the Fall Brook road it was a pleasure to find much of the unexpected. It is a bigger road than it looks. The discipline is good; wrecks few, and interested men everywhere.

The Fall Brook is a coal road, but does quite a general business. It is 257 miles long, all single track, and hauls an annual tonnage of over six millions.

During the past two years they have had but one wreck that cost $1,000. This one was caused by broken material, not by carelessness of the men, and cost $1,800.

We found that the men were making good pay, but that the overtime paid was *more than 60 per cent. less than in former years.* That shows good train handling, both in the office and on the road.

We found that the cost from wrecks was 32¼ per cent. less than the average of former years, and we found that the cost of keeping up the road-bed was some $33,-174 00 less than the average of the seven previous years—the tonnage was greater, something else was at work, what was it?

In the first place, good wages. Engineers get $3.25 the first year, $3.50 the second and $3.75 thereafter for 100 miles or less. Conductors get $2.25, $2 40 and $2 50, and a prize of $60 per year if they render entire satisfaction, and this $60 commences the first year. Brakemen get $1 62½ the first year, and $1.75 thereafter; flagmen $1.85; firemen $2.20, and all are paid for overtime.

The prize helps out in attention to every detail by conductors.

There are three prizes of $40, $20 and $10 to each division for the best kept section—some of that $35,000 saving comes from this.

Men are promoted on merit, the oldest having the preference if equally bright.

Every man in the service knows that he will get fair treatment, that he will be reasoned with and given a show to explain his case and to do better, and that no one but himself and "G. R. B." will know what was said or done. Every one of them knows that he is expected to be thoughtful and careful, and to try and render the best service; but that he is not expected to be infallible nor to never make a mistake.

The spirit of fairness, and frankness, and cordiality and co-operation is in the air, and it's a poor man that don't want to do his whole share toward making a success of his daily work under such conditions.

Isn't there a lot of railroad officials in this country who would secure better service for their companies if they would introduce some of the Fall Brook methods? Is a good "disciplinarian" necessarily a butcher or an executioner?

"The Iron Founder" Supplement is a new volume on the art of casting in iron, supplementing and bringing up to date the well-known book, "The Iron Founder," by the same author, Mr. Simpson Boland. The work contains some 200 engravings, and has 400 pages. Price, $2.50. Published by John Wiley & Sons, New York.

Inferior Cast-Iron Wheels.

Since the Master Car Builders' and the Master Mechanics' Associations adopted standard specifications for cast-iron wheels, there has been less trouble experienced with breakage of wheels than there had ever been since heavy loads and fast time became common. This highly desirable improvement arose from the fact that better material was used and better wheels made than formerly. It was high time that a change for the better came about, for the breakage of cast-iron wheels was becoming so common that a feeling was growing that cast-iron wheels were not reliable enough to be employed in trains that ran faster than twenty miles an hour. A good cast-iron wheel is perfectly safe and reliable for ordinary roads and common train speeds, but a badly-made cast-iron wheel is too dangerous to be employed under any car. The practice of making inferior cast-iron wheels arose from reckless competition, which encouraged a demand for cheapness. A good cast-iron wheel could be sold at such a ridiculously low figure, that the most unscrupulous buyer had no reason to demand a reduction in price; but competitors volunteered to do this, and figures were quoted that good cast-iron could not be purchased for. The reckless maker of the cheapest wheels got the business, and reputable makers were compelled to adopt cheap material and cheap methods or lose sales. Not a few wheel makers refused to make inferior wheels, and the consequence was that their works were nearly idle, while the works of the cheap makers were crowded with orders.

The standard specifications referred to had for a time a most depressing influence upon the manufacture of inferior wheels, and everybody except those who thrive on roguery were benefited. The makers were placed on a level and every one received business according to his capacity for securing it, the railroad companies received reliable wheels which gave good service and were safe, and the trainmen were not in constant danger of disasters due to the breakage of wheels. There was no reason why this desirable condition of affairs should be changed, but we regret to learn that a change for the worse is going on. The depression in business has rendered the word "cheap" unusually attractive, and the disreputable wheel maker is around seducing purchasing agents into ordering wheels at a price too low for the manufacture of a good article. Railroad companies have reaped the benefit of the low price of cast-iron, for the price of wheels has gone down to accord with market quotations, but some buyers are not satisfied with this and are ready to put under cars wheels furnished at a price about which good iron costs in the pig. We do not understand how these makers are going to get round the standard guarantees, but they expect to elude their requirements in some way. They are not making wheels that will stand the drop-test and the test of service. This is a good time for all concerned to make certain that the wheels supplied are qualified to pass through the drop-test. If the men in charge of the mechanical departments would be a little vigilant at present in seeing that worthless wheels are not accepted, the tendency towards inferior material will be checked before much damage is done.

The memory of purchasers of railroad supplies is exceedingly short, so the difference between the wear of good wheels and bad ones is already, no doubt, forgotten. As a stimulant to some memories we might mention some facts brought out in an investigation of car wheels removed on the Erie railroad in 1884. The wheels were classed according to the maker from best to worst. The worst maker had more than twice as much breakage of wheels as the best, and he had more than three times as many which were removed for being cracked, while he had nearly five times as many that were taken out of service on account of sharp flanges. The broken and cracked wheels of the worst maker averaged ten per cent., while that of the best maker was less than one per cent. About the time this record was made another road that was buying $7 car wheels, had to remove 4,300 in twenty-eight days for dangerous defects.

When we consider the expense and inconvenience resulting from cars being taken out of service prematurely to have poor wheels changed, it will be found that the practice of using inferior wheels is too expensive for most roads to prosper under.

It would be well for those immediately responsible for the purchase of cheap wheels to reflect on some of the probable results of this pursuit of short-sighted economy. A saving of one or perhaps two dollars a wheel may be effected by the purchase of the worst wheels in the market, and the probabilities of accidents to rolling stock increased ten-fold. This means increase of ultimate expense out of all proportion to the saving in first cost, and it involves reckless trifling with the lives of every person riding on trains where these inferior wheels are employed. The speed at which trains are now run calls regularly for powerful application of brakes and the protracted action of the brake-shoes on cast-iron wheels has a searching action upon the best of them. For this reason inferior wheels are likely to be much more dangerous to-day than they were eight or ten years ago, and the harvest of wrecks will be more fertile than it was at that time when the accidents caused by breakage of inferior wheels stirred up an agitation to prohibit the use entirely of cast-iron wheels on the ground that they were all dangerous. It would be well for railroad companies to refrain from practices likely to arouse another agitation of this character, for there are now powers in existence which could make demands for safer wheels in a manner not to be denied. The neglect of simple appliances that were calculated to prevent accidents to men coupling cars led to the enactment of laws relating to automatic couplers. The use of inferior cast-iron wheels might work up public sentiment in favor of laws to compel railroad companies to use steel wheels under all their rolling-stock.

Engineers Young at Forty-five.

During the recent trouble on the Lehigh Valley road one of the officers remarked that it was a good thing, as they wanted to get rid of some of the old fossils, and ended his remarks with the statement that he "didn't want any engineers that were forty-five years old."

We would arise to remark that the man who said this was an officer in the transportation department, and not in the motive power department—the latter know better.

An engineer ought to be—and generally is—at his very best at 45 to 55 years of age, he has experience, judgment, and is usually a steady, regular and reliable man.

There is too much of this dividing men into classes, "the old-time rocks" and the "young blood, with progressive ideas"—as one of them remarked to the writer.

Men with ten or twenty years' experience are too prone to belittle the "kids," or "tid-bits," as he calls the younger runners. If a man is cut out for the business he can be a good engineer at twenty-five; but he will be a better one when he gets to be forty-five. The young man who was designed by nature for a car-driver or the ministry won't do any good running at twenty-five or forty-five either. The two best locomotive engineers whom the writer ever knew—and he knows some thousands—one was more than sixty years old and the other was not yet twenty-three.

Both of them knew their business thoroughly. Both knew what to do with the power in his hands at all times, and what *not to do*. Ah, there is where so many men miss it. Did you ever stop and think that a locomotive engineer is paid just as much for knowing what *not* to do as he is for knowing what to do? Life, property, and reputations depend on his knowing the *not* as well as the *what*.

All honor to the man, of any age, who studies his business and tries to be a good engineer, and all honor to him as his years of experience increase. However good he may be while young and frisky, he'll be better at forty-five than he ever was before. He may not be as "fly" but he will "get there just the same"—and you can depend on him.

Where Oil is Charged to the Engineer, Not to the Engine.

On the Fall Brook road the engineers are allowed to use 30 cents worth of lubricating oil for 100 miles run with engines having four drivers coupled, 35 cents for six-wheel coupled engines and 40 cents for consolidations.

At the end of each month the bulletin shows how much over or under the amount of allowance has been charged, and at the end of the year a grand total is put up. Oil is charged to the men, their cans are all taken off the engines on arrival and locked up, and put on again when they are going out. We have before us the report for the first eleven months of 1893. It shows that some of the men run on half the amount of oil that others do. The best man on the list has $51 81 to his credit, the poorest man is $27.76 "in the hole," but his average is so much worse than any of the others it is only fair to assume that something was wrong with his engine, though he used more of every kind of oil than any of the others. The general average shows that the men who used more oil than they ought to drew $243.28 worth over their allowance, but the men who used less saved the company $954.18.

General Superintendent Brown says that, taken as a rule, it will be found that the best men on the oil record are the best men on everything else. We suggest that if the company will say to these men, "We will give you half what you save," and then cut the allowance five cents per class, they will be more money in at the end of the year and the boys will be making something out of it. Nothing encourages men to try like getting well paid for trying. But prizes have been known to make thieves of men, and too much "economy" of oil has cut many an eccentric.

The Pullman Palace Car Co. has been compelled to pay $150 stolen from a passenger in one of its sleeping cars. This company never pays any damages until compelled to do so, and this case was fought to the Supreme Court, but was finally decided against the company. A sleeping car company holds an undefined position in its relation to patrons. It is not liable as a common carrier, and it is not held liable as a hotel keeper. For this reason sleeping car companies have escaped being held when common sense indicated that they were responsible for loss of property. The decision made against the company in the present case was given on the grounds that its servants were bound to watch over the property of sleeping passengers, and this duty was neglected. The decision is likely to be highly important as a precedent. Perhaps it may interfere with the quiet slumbers of the ordinary sleeping car porter, who watches over the passengers with his eyes shut and his mouth open.

When an announcement is made that the office of general manager, superintendent of motive power, chief engineer, or purchasing agent has been abolished, it means that one higher in authority has been trying to get rid of the existing incumbent, and had not the moral courage to ask him to get out.

We have no back numbers of any kind, bound or unbound, beyond this year. Will keep back numbers only during current year.

PERSONAL.

Mr. E. M. Hedley, master mechanic of the Brooklyn Elevated Railroad, has resigned.

Mr. B. R. Hanson has been appointed master mechanic of the Texas Midland Railroad, with headquarters at Terrell, Tex.

Mr. William Saxton has resigned as master mechanic of the Washington & Columbia River, and the office has been abolished.

Mr James Henry has been appointed manager of the Lehigh Valley Transportation Company, in place of Mr. John Gordon, resigned.

Mr Thomas B. Purves, Jr., has been appointed master mechanic of the Boston division of the Boston & Albany, in place of Mr Taft promoted.

Mr Edwin Priest has been appointed master mechanic of the Boston & Albany, at East Albany, succeeding Mr. T. B. Purves, Jr., transferred.

Mr Clarence F. Parker has been appointed assistant general manager of the St Louis, Alton & Terre Haute, with headquarters at St Louis, Mo

Mr James A. Gohen has been appointed master car painter of the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Indianapolis, Ind.

Edward Richardson, master mechanic of the Pittsburgh, Shenango & Lake Erie, died at Greenville, Pa., Jan 3d, of paralysis. He was 64 years of age.

Mr James W. Dalby has been appointed division superintendent of the Kansas City, Wyandotte & Northwestern, with headquarters at Kansas City, Kan.

Mr. John C. Smithom has been appointed superintendent of the supply department of the Lehigh Valley, at Hazleton, Pa., in place of Mr T. M. Santee, resigned.

Mr W R Woodward has been appointed general manager of the Toronto, Hamilton & Buffalo, with headquarters at Brantford, Ont., in place of Mr. James N Young, resigned

Mr. C C. Riley has been appointed chief clerk of the car service department of the Cleveland, Cincinnati, Chicago & St. Louis at Indianapolis, Ind., in place of Mr. G. M Lowe, resigned.

Mr. E. M Humstone has been appointed master mechanic of the Philadelphia, Reading & New England, with headquarters at Hartford, Conn., in place of Mr. J. L. Ellis, resigned.

Mr. William H Taft, who has been for seven years master mechanic of the Boston division of the Boston & Albany, has been promoted as acting superintendent of motive power of the road.

Mr. Henry Limbacker, assistant timekeeper of the Baltimore & Ohio, at Newark, Ohio, has been appointed general car inspector of the Elgin, Joliet & Eastern, with headquarters at Joliet, Ill.

Mr. J. N. King, assistant train-master of the Lehigh Valley at Sayre, Pa., has been appointed superintendent of the Seneca division of that road, with jurisdiction from Manchester to Coxton, Pa.

Mr. Joseph Hill, assistant general manager of the Terre Haute & Indianapolis (Vandalia Line), has been appointed general superintendent of that road, with headquarters at Terre Haute, Ind.

Mr J A. Conant, chief clerk to the general superintendent of the Baltimore & Ohio Southwestern, has been also appointed superintendent of car service of that road. Headquarters, Cincinnati, O.

Mr. J M. Winslow has been appointed superintendent of motive power of the Washington & Columbia River, in place of Mr. William Saxon, master mechanic. Headquarters, Hunt's Junction, Wash.

Mr. R. B. Starbuck, superintendent of the Peoria, Decatur & Evansville, has been appointed general agent for the receivers of that road, in charge of the operating department. Headquarters, Mattoon, Ill.

Mr. C R. Church has been promoted to the position of roundhouse foreman of the St. Louis & Southwestern with headquarters at Pine Bluff, Ark Mr. Church has been a machinist and gang foreman in the repair shops of the company.

The United States Metallic Packing Co have opened a new western office in the rotunda of the Grand Pacific Hotel, Chicago Mr Harry A. Pike and Mr Edwin N Hurley have been put in charge, and propose to cultivate the field assiduously

Mr. H. O. Hukill has been appointed purchasing agent of the Pennsylvania lines west of Pittsburgh, with headquarters at Pittsburgh, Pa., to succeed William Mullins, deceased. Mr. Hukill has heretofore been assistant in the purchasing agent's office

We shall soon publish an interesting article from the pen of W. F Dixon, chief draughtsman of the Rogers Locomotive Co., on tenders Mr. Dixon has been making some interesting comparisons of weight, capacity and cost of different kinds of tenders

Mr. P. P. Fowler has been appointed division master mechanic of the Western New York & Pennsylvania, with headquarters at Oil City, Pa. He was formerly general foreman of the West Shore shops at Buffalo, and is spoken of as an excellent mechanic and manager of men

Mr M. P Barry, formerly connected with the Wisconsin Central, has been appointed general superintendent and traffic manager of the Rice Lake, Dallas & Menomonie, which was recently completed from Rice Lake to Cameron, Wis., 7½ miles, and which is being extended to Menomonie

Mr Alexander Mitchell, superintendent of motive power and rolling stock of the Lehigh Valley, has been appointed superintendent of the Wyoming division of that road, with headquarters at Wilkesbarre, Pa., and the office of superintendent of motive power and rolling stock has been discontinued.

Mr. John W Mulford, traveling engineer of the Central Railroad of New Jersey, died on January 2d. He learned the machinist trade in early life, and in 1858 began work on the Central as locomotive engineer. Ten years later he was promoted to the position of traveling engineer and retained it till he died.

Mr. N. K Elliott, superintendent of transportation of the Terre Haute & Indianapolis, has been appointed superintendent of the main line and Michigan division, with increased duties. He will have supervision of shops, road work and engineering work, and the operation of trains Headquarters, Terre Haute, Ind.

Mr W. T. Rupert, general foreman of the Missoula shops of the N. P. R. R., has resigned. Mr. S. W Cooley has been appointed as general foreman in Mr. Rupert's place Mr. Rupert goes to Ionia, Mich., to take charge of shops there under Superintendent of Motive Power B Haskell, of the Detroit, Lansing & Northern Railway.

Press dispatches from San Francisco lately intimated that Mr A N. Towne, general manager of the Southern Pacific, was about to retire. The report, which appears to come up periodically, is vigorously denied by President Huntington, who appears to have a fair estimate of Mr. Towne's qualifications as a railroad manager.

Mr. William S Eaton has resigned as treasurer of the National Tube Works Co., of Boston. Mr. Eaton has held the position for twenty-four years, and a great share of the company's prosperity has been due to his admirable financial management It is reported that the company is only doing 60 per cent. of the business done a year ago. Its railroad business is said to be falling off very much

Some of the committees of the Master Car Builders' Association appear to be determined to exhaust the subjects they have been appointed to report upon. The Committee on "Freight Car Tracks," of which Mr. J. J Hennessey is chairman, have sent out a circular containing nineteen questions; the Committee on "Lubrication of Cars and Prevention of Hot Boxes," of which Mr. A. M. Waitt is chairman, have sent out a circular containing forty-five questions. If the members will answer questions good reports will be presented.

Mr Joseph Billingham has been appointed master mechanic of the Baltimore & Ohio, with headquarters at Garrett, Ind., in place of Mr. G. R. Ott, deceased. Mr. Billingham was for some time a traveling engineer on the Chicago, Milwaukee & St. Paul, and left there to be a master mechanic on the Atchison, Topeka & Santa Fé. From that he was appointed to take charge of the machinery of the Gulf, Colorado & Santa Fé, a position he held with much credit until a new ruler came in who knew not Joseph. He is a very able master mechanic, and will succeed on the Baltimore & Ohio.

In a reminiscent article which appeared in our January issue concerning the pioneer railroad manager, Chauncy Vibbard, the printers made the name begin with H. This has brought us a flood of corrections Owing to the personal connection, we quote a letter from Mr. Wm. Foote, of the Nathan Mfg. Co., as follows "In your article on a veteran manager of the New York Central Railroad, long since passed away, you speak of Chauncey Hibbard. I presume you mean Chauncey Vibbard I can go back several decades, but I can recall no Chauncey Hibbard, but I knew Chauncey Vibbard very well, and he was a good one After leaving the New York Central he was of the firm of Foote, Vibbard & Co., and that was the last of his real active life."

Mr. J K. Bole has resigned his position as managing director of the Otis Steel Co., of Cleveland. It is generally admitted that Mr Bole did the most valuable work in pushing the Otis Steel Co. to the high position it held for several years. Two or three years ago an English syndicate secured control of the Otis Co., and they are now moving to take the entire management of the company into their own hands. The management of American companies by English capitalists has generally proved highly beneficial to rivals and competitors. The new owners of the Otis Steel Co. ought to have held on to Mr. Bole if they wanted to retain their railroad business. No man is more popular in this field, and his place cannot be filled, so the company is certain to suffer, even though some strong men are retained.

Mr John G. Neuffer has been appointed general master mechanic of the Baltimore & Ohio Southwestern Railway, with headquarters at Cincinnati, Ohio. Mr. Neuffer deserves great credit for the progress made, as his age is about 35 years. He entered service in the shops at Chillicothe, O., as an apprentice in the machine shop After he served his time, he went on the road as fireman; he fired but a short time, then he was promoted to engineer; he served as engineer for a few years, then he was promoted to roundhouse foreman, at Portsmouth, O., he was shortly afterwards appointed road foreman of engines, and served in that position about one year; he was then appointed master mechanic of shops at Chillicothe, O., and since the consolidation of the O. & M., and the B. & O. S. W. Railroad, Mr. Neuffer has been appointed general master mechanic of the whole system, B. & O. S. W. Railway.

A correspondent writes us "We have all been expecting that you would say something nice about the promotion of Mr. Smith to be general foreman of our shops. He has been a warm friend of Locomotive Engineering, and all his friends think that you might have said something good about him." We have received complaints of this character before, but we are not to blame for not giving the expected personal notice. Unless a printed bulletin of promotion is issued, we are unlikely to learn about it except through the letters of correspondents. If any one who is interested in the promotion of any railroad officer will send us particulars, we will gladly publish them. Some facts about the railroad career of the men promoted are always welcome and interesting. Send in the facts, and you will have no reason to complain that Locomotive Engineering neglects the personal announcements

A notice has been sent to us by Secretary Cloud, of the Master Car Builders' Association, intimating that lithographs of the standards are ready for sale The sheets, which are on transparent paper, suitable for making blue prints, cost only twenty-five cents each, and ought certainly to come into general use. The drawings of M. C. B standards which we find in drawing offices are very rarely accurate, and the departures from the proper dimensions cause no end of annoyance. All these drawings ought to be burned and the accurate lithographs put in their place. The producing of accurate drawings to represent the standards as they are was an important work for the M. C. B. Association to perform. Those interested ought now to lose no time in displaying their appreciation of the work done, by purchasing and using the lithographs. Those who fail to do this, and who use inaccurate drawings, are unfaithful to the interests of the company they serve and they act unjustly towards all roads interchanging cars with them.

The following notice has been issued by Mr. Joseph Wood, general manager of the Pennsylvania lines west of Pittsburgh, and supplements information we gave three months ago · Mr. E. B. Wall has been appointed assistant to the general manager. He will have supervision of all requisitions for the purchase of articles in general use in every department of the company's service, and will be specially charged with the purchase of fuel, cross-ties and new equipment. In cases where, in his judgment, it would seem wise to make a modification of a requisition, either as to its character, quantity or quality, he shall communicate direct with the officer in whose department the requisition originated, to the end that the question may be promptly adjusted. He will frequently visit the shops and other points on the lines where material is consumed, and all officers are directed to afford him full information in connection with the character, quantity and quality of supplies received. The purchasing agent will consult freely with him on all matters relating to his department.

EQUIPMENT NOTES.

The Armour Packing Co., of Chicago, have ordered 200 refrigerator cars from Wells French.

The Consolidated Car-Heating Co. have declared the usual semi-annual dividend of three per cent.

The Lake Street Elevated Road, of Chicago, have ordered twenty-three coaches of Pullmans.

The Delaware & S. S. R. are in the market for ten very heavy mogul locomotives and 500 cars.

The East Tennessee, Virginia & Georgia are reported to have ordered some passenger cars from Pullmans.

The Atlantic Coast Line are reported to be in the market for four mogul locomotives intended for the heavy freight service of the road.

The Lee Composite Mfg. Co. intimate by circular that they have made new arrangements which will enable them to supply their roofing and paint materials much more promptly than hitherto.

An injunction has been issued by Judge ..., of the United States Circuit Court, against the Eames Vacuum Brake Co., restraining them from manufacturing air brake apparatus that infringes the broad claims of the Westinghouse patents.

The Consolidated Car-Heating Co., Albany, N. Y., has received a second order from England for direct steam storage heating equipments. These equipments are so arranged that the temperature in each compartment can be separately regulated.

The Burlington, Cedar Rapids & Northern have ordered 100 stock cars from Barney & Smith, Dayton. They will be equipped with all modern improvements, including Westinghouse air brakes, M. C. B. couplers and National hollow brake-beams.

The gauge-glass cutter, handled by Stannard & White, Appleton, Wis., received the highest award at the World's Fair. It is an inexpensive little device which ought to be in every engine-house, for it will save its cost in gauge-glasses every year.

The Chicago, Burlington & Quincy have ordered twenty Rodger ballast cars for immediate delivery. Several other railroad companies are figuring on the purchase of Rodger ballast cars, the depression of business being the only obstacle to the placing of orders.

Some time ago the Schoen Mfg Co., of Pittsburgh, sent out for trial on various roads brake-shoes made of pressed mild steel. The tests of service on chilled wheels show that the steel brake-shoes outwear eight cast-iron shoes. While giving this great increase of service, they do the work of stopping the trains as well as the best cast-iron shoes, and produce no perceptible wear on the wheels.

Sherburne & Co., of Boston, are putting upon the market a lamp-shade made of silver-covered strips, braided in basket shape, but retaining the ordinary form. It has a peculiar power of reflecting the light, and seems to be particularly well adapted for car service. It is more attractive and efficient than the ordinary porcelain shade, and will prove cheaper, as it is not subject to breakage.

On another page will be found an article arguing for better cast iron wheels. Since that article was written we have come across some actual cases of cheap wheels. When a 550-pound wheel can be furnished, *with a five-year guarantee*, for $5 25, there's something rotten in Denmark. We know of several offers of $5.40 for this weight of wheel. Good, even ordinary, wheels cannot be made for the money.

The C., C., C. & St. L., otherwise known as the "Big Four," the Lehigh Valley, the New York, Ontario and Western, the Fall Brook, the Connecticut River, and the Boston & Albany railroads have recently abandoned all other patterns and have made the Sewall coupler their stan ard. The Consolidated Car-Heating Co., Albany, N Y., has sold over 10,000 Sewall couplers since the beginning of the present heating season.

The Jerome Metallic Packing Co., of Chicago, are fairly busy with the manufacture of their well-known gland packing A new industry has been added to the shop in the form of an aluminium horse-shoe, invented by Mr. Jerome. The most valuable feature about this shoe is its lightness, but Mr. Jerome has added the quality of durability He presses crushed hardened steel into the bottom of the shoe and thereby imparts wearing qualities far beyond anything attained by an iron shoe.

The Lake Street Elevated Railroad of Chicago have ordered ten new compound locomotives from Rhode Island. Of twenty-five locomotives that the company have in service, twenty are compounds of the two-cylinder type. This is a road where the compounds are decidedly more popular with the men than the simple engines. They are as easily worked, and are decidedly more economical in the use of fuel. The locomotive performance-sheet of the company for last December is before us, and it shows that the simple engines used 45 pounds of coal per train-mile, while the same work was done by the compounds on 35 pounds of coal The best performance of the simple engines was 39 pounds of coal per train-mile, and the best performance of the compounds was 29 pounds. This is a saving of about 26 per cent. The total cost of operating per mile is 13 6 cents for the simple and 11 cents for the compounds, the saving in this is 20 per cent. The water consumption of the compounds agrees very closely with the saving of coal effected

Trying to Change the Methods of Railroad Purchasers.

There are some peculiarities about the railroad supply business that are not to be found in other lines of supply trade. Railroad purchasing agents, and the men behind them who inspire orders, like to get the full worth of the money expended, but they do not usually buy at the lowest price or require a strict guarantee as to the quality of the goods. Confidence in the integrity of the seller is considered of greater value than guarantees or low prices. Guarantees have so often proved a delusion and a snare, and low prices the assurance of inferior material, that the personal equation has gradually grown into favor, and goods are selected because it is known that the seller is reliable.

It is well for people who wish to secure railroad trade to understand that it can only be secured through the recognized channels, in which agents are looked upon as guarantees that the material supplied is of the quality represented. There have been repeated attempts to break down this system, but it always resulted disastrously to those who kicked against the pricks.

We have within our memory a firm selling steel plates, which decided that special agents for the railroad business were not in harmony with the firm's decalogue of organization. The heads of the firm saw no reason why railroad men in want of steel should not apply to the local agents for what they wanted, so the fiat went forth that railroad companies in certain districts wanting steel plates should conduct their negotiations through the local agents. It is needless to say that the other fellows got the business

A more melancholy instance of the fatuity of trying to compel railroad companies to depart from their established habits was a firm which had built up a fine, lucrative business in the manufacture of several staple articles used by railroads The concern was worked up from a very humble beginning by the skill, energy and business capacity of the originator. He made nothing but first-class goods, and had the sagacity to employ sales agents who had a friendly acquaintance among railroad men and knew how to explain the merits of the goods they had for sale. Business grew rapidly, large extensions were made in the works, and a stock company was formed, but the man whose personal ability had earned success held on to sufficient stock to control the others and with an increased business he held on to the old methods that had earned the confidence of buyers.

In the course of nature, however, the old man was called hence and a son entered into control. This son has many good qualities and might have been as successful as his father had he begun his working life with a hammer in his right hand. But he began at the top, and the details that contribute to the success of a business were not understood. He was a believer in arbitrary organization. The impression came to him that the selling department of the concern was not perfectly organized, so he turned down the men who had done the selling in the old way and established a system of geographical agents. The personnel of the agents he considered a secondary matter. The reputation of a great firm was, in his opinion, the secret of success. Railroad companies, he supposed, would never be so insane as to purchase from small concerns while his great spread eagle existed to attract attention.

The old man had insisted on the policy that the best article that could be made in a commercial way was not too good for railroad use. The young man adopted the policy that railroad companies in want of cheap goods should be supplied with what they were willing to pay for.

The hard times have come, and no concern in the country has been struck so hard as the firm we are writing about. The geographical organization did not work well. Purchasing agents did not go out looking for sales agents they had never seen, and the orders were given to other firms whose agents were watching to catch the business fruit when it was ready to drop. The rivals, seeing the weak point in the armor of their adversary, shouted for the best material only, and supplied it. The large firm is prostrated for want of business, and small ones are building themselves up on what it has lost.

An English schoolmaster once moved into a western country, and finding that teachers were not in demand, he put all he had into a village store and turned general merchant. His old business being that of instruction, he presumed that he could engraft the principles thereof upon the new business. When a housewife ordered anything that was not in the store, he insisted on her taking the thing in stock that most closely resembled it. When a hired girl came for goods, he told her to send her mistress, as he preferred to deal with the principal. His business was not a roaring success, and on the day that the sheriff took possession he acknowledged that buyers were surprisingly independent people.

Those who set out to change the ways of railroad buyers to suit their own organization are liable to make the acquaintance of sheriffs.

Good Iron Makes Stay-bolts Durable.

A talk which Mr. J. N. Lauder gave in the New England Railroad Club, on broken stay-bolts sustains the principles which we have advocated so strongly in favor of first-class material. Mr. Lander said

"We have such good results in this matter of stay-bolts in boilers of our own design, and of recent build, that I am through telling it to my Western friends, because they will not believe it Now, I will make a statement which can easily be verified, which is, that in the last ten years there have been built seventy-five boilers under my supervision and of my own design, and we have had just seven broken stay-bolts. They have been running from two months to eight years. The first boiler we built to carry a pressure of 175 to 180 pounds, and in that boiler we have had up to this time three broken stay-bolts

"I have seen boilers within two years that had every stay-bolt in the boiler taken out in less than two months after their delivery. The stay-bolts were not broken but were cut too small, and did not fill the holes A stay-bolt should have a good thread, the hole should be carefully threaded, and the bolt should fill the hole. The less pounding done on the end of that stay-bolt the better. My iron for stay-bolts costs six and one half cents in the bar."

We are informed that the iron referred to is "Taylor" best Yorkshire stay-bolt iron.

Improved Heat Measurer.

It is many years since the scientific world began to devise appliances for measuring high temperatures, but the progress in this department of inquiry has been very unsatisfactory. The temperatures that can be measured by mercurial or spirit thermometers are obtained with reliable accuracy, but when the heat gets beyond the gauge of these appliances the records are very unsatisfactory. One of the most accurate methods for measuring high temperatures is to place a piece of refractory metal of known weight and capacity for heat in the place to be tested, leave it there till it becomes of the same temperature and then plunge it in a vessel containing an accurately measured quantity of water. By finding the rise of temperature due to the metal a simple calculation shows the temperature of the place where the metal was heated. The objection to this means of measuring temperature is that it cannot be used conveniently in many cases.

It would be very important to have easy and accurate means of showing the temperature of locomotive smoke-boxes, but the appliances commonly employed are so inaccurate that the records are worthless. We are glad to see that Professor Austen, of England, who has been devoting much attention to the measurement of high temperatures, has devised a pyrometer which promises to be more accurate than anything of the kind hitherto tried. It is a thermo-junction of platinum and platinum alloyed with rhodium; this is attached to a galvanometer, and the spot of light from its mirror is received on a revolving drum covered with sensitized paper. The curves exhibited give a twenty-four hours' record of the variations in the temperature of the blast supplied to furnaces smelting iron. It is thus possible to account for the variations in the working of these large structures, and by insuring regularity of work to avoid the occurrence of these variations, also to effect economies of fuel, which, it is anticipated, will attain very large proportions and will prove to be of great industrial importance in conducting this important branch of metallurgy. It is also certain to be used in showing the heat loss that passes through the smoke-boxes of locomotives.

If a good practical and simple pyrometer was placed on the market, it would be highly valuable for locomotives as a fixed attachment. When it indicated an abnormal temperature, changes would be made which would reduce the waste of heat.

Development of the American Car.

The American railroad train is famous for steady, easy riding, the inventive ability and ingenuity of several generations of mechanics having been exhausted to bring about the perfect conditions now reached by Miller platforms and coupler-pressure vestibules, and hydrostatic or heavy friction buffers. There are men, well advanced in life, brought up in this country, who think that the American car has always been the steady-riding vehicle now found on all railroads. The following extract from "Railroad Accidents," by Charles F. Adams, will give many of our readers an insight into past imperfections that they little realize:

"The original idea of the railroad train was a succession of stage coaches chained together and hauled by a locomotive. The famous first train on the Mohawk Valley road was literally made up in this way, the bodies of the stage coaches having been placed on trucks, which were coupled together with chain links, leaving from two to three feet of slack. When the locomotive started it took up the slack by jerks, with sufficient force to jerk the passengers out from under their hats, and in stopping they came together with such a force as to send them flying from their seats. On this trip, the train came to a stop, when the passengers, with true American adaptability, set their wits at once to the work of devising some means of remedying the unpleasant jerks. 'A plan was soon hit upon and put in execution. The three links in the couplings of the cars were stretched to their utmost tension, a rail, from a fence in the neighborhood, was placed between each pair of cars and made fast by means of the packing yarn from the cylinders.' Here was the incipient idea of couplers and buffers improvised by practical men, and for a third of a century it remained almost unimproved upon, except by the introduction of a spring upon which coupler and buffer played. The only other considerable change made in the earlier days of car construction was by no means an improvement, inasmuch as it introduced the new and wholly unnecessary danger of telescoping.

"The original passenger cars, however frail and light they may have been, were at least, when shackled together in a train, continuous in their bearings on each other—that is, their sills and floor timbers were all on a level and in line, so that, if the cars were suddenly pressed together, they met in such a way as to resist the pressure to the extent of their resisting power, and the floor of one did not quietly slide under or over that of another. The bodies of these cars were about thirty-two inches from the rails. This was presently found to be too low. In raising the bodies of the cars, however, the mechanics of those days encountered a practical difficulty. The couplings of the cars built on the new model were higher than those of the old. They at once met, and, as they thought, no less ingeniously than successfully overcame this difficulty, by placing the couplings and draw-heads of their new cars below the line of the sills. This necessitated putting the platform which sustained the coupling also beneath the sills, and in doing that they disregarded, without the most remote consciousness of the fact, a fundamental law of mechanics. With a possible pressure both sudden and heavy to be resisted, the line of resistance was no longer the line of greatest strength. During thirty years this stupid blunder remained uncorrected. It was, as if the builders during that period had from force of habit insisted upon always using as supports, pillars which were curved or bent instead of upright. At the close of those thirty years also, the railroad mechanics had become so thoroughly educated into their false methods that it took yet other years and a series of frightful disasters, the significance of which they seemed utterly unable to take in, before they could be induced to abandon those methods.

"The two great dangers of telescoping and oscillation were directly due to this system of car construction and of train coupling—and telescoping and oscillation were probably the cause of one-half at least of the loss of life and the injuries to persons incident to the first thirty years of American railroad experience. The badly built and loosely connected coaches of every train going at any considerable rate of speed used then to swing and roll about and hammer against each other after a fashion which made the infrequent occurrence of serious disaster the only fair subject for surprise. In case of a sudden stoppage or partial derailment, the train stopped or went on, not as a whole, but as a succession of parts, while the low platforms and slack couplings fearfully increased the danger—for if the train held together, the cars in stopping were likely to break off the platforms, making of what remained of them a sort of inclined plane over which the car bodies rode into each other at different levels; or, if the couplings, as was more probable, held and the train did not part, the swaying and swinging of the loosely connected cars was almost sure to throw them from the track and break them in pieces.

"The invention through which this difficulty was at last overcome, simple and obvious as it was, is fairly entitled, so far as America at least is concerned, to be classed among the four or five really noticeable advances which have of late years been made in railroad appliances. It contributed unmistakably and essentially to the safety of every traveler. Known as the Miller platform and buffer, from the name of the inventor, it was, like all good work of the sort, a simple and intelligent recurrence to correct mechanical principles. Miller went to work to construct cars in such a way as to cause them to come in contact with each other in the line of their greatest resisting power, while in coupling them together in trains he introduced both tension and compression—that is, he, in plain language, brought the ends of the heavy longitudinal floor timbers of the separate cars exactly on a line and directly bearing on each other, and then forced them against each other until the heavy spring buffers which played on those floor timbers were compressed, when the couplers sprung together and the train then stood practically one solid body from end to end. It could no more swing or crush than a single car could swing or crush. It then only remained to increase the weight and to perfect the construction of the vehicles to insure all the safety in this respect of which travel by rail admitted.

"Simple as these improvements were, and apparently obvious as the mechanical principles on which they were based now seem, the opposition for years offered to them by practical master car builders and railroad men would have been ludicrous had it not been exasperating. There was hardly a railroad in the country whose officers did not insist that their method of construction was exceptional, it was true, but far better than Miller's. It was maintained that the slack couplings were necessary in order to enable the locomotives to start the trains; that a train made up without the slack, on Miller's plan, could not be set in motion, and that if it was set in motion, it must twist apart at every sharp curve, etc. The ingenuity displayed in thus inventing theoretical objections to the appliance far exceeded that required for inventing it, and indeed no one who has not had official experience of it can at all realize the objecting capacity of the typical practical mechanic, whose conceit as a rule is measured by his ignorance, while his stupidity is unequaled save by his obstinacy. Even when Miller's invention, for one reason or another, was not adopted, the principles upon which that invention was founded—the principles of tension, cohesion and direct resistance—at last forced their way into general acceptance. The long-urged objection that the thing was practically impossible was slowly abandoned in face of the awkward but undeniable fact that it was done every day, and many times a day. Consequently, as the result of much patient arguing, duly emphasized by the regular recurrence of disaster, it is not too much to assert that for weight, resisting power, perfection of construction and equipment and the protection they afford to travelers, the standard American passenger coach is now far in advance of any other. As to comfort, convenience, taste in ornamentation, etc., these are so much matters of habit and education that it is unnecessary to discuss them. They do not affect the question of safety."

Uncle Sol.'s Ways.

"There is something strange about Uncle Sol.'s way of handling his engine and train," remarked the traveling engineer as he spread the aroma from one of the scribe's perfectos through the instruction car.

"What is there strange about Sol.? I thought he was a first-class engineer."

"So he is; but he never appears to read a book or a paper, and yet he follows the practices you book-making engineers lay down as the proper way to get the best work out of an engine, and there is no man handles brakes better, although I don't suppose he could tell a thing about the inside of our engineer's valve or an air-pump."

"Perhaps he fired for an intelligent man who understood the principles of steam engineering and carried them into practice on the locomotive?"

"No; he tells me that most of his firing was done for a man who always ran throttling, preferred choked nozzles, and who used the smokestack for a gauge-cock."

"How is he on noticing things? A man of keen, observing habits will get to the right way by learning step by step, letting performance root out the habits acquired of prejudice. The principles given in books are merely the select teachings of experience."

"There you have him. Sol. remembers more about how his engine worked at particular places than any man I know. He sees everything that happens and notes the cause of anything out of the ordinary. Another thing that helps Sol. is that his attention is always upon his engine and train. Nothing takes his mind away from these, and his engine has the best share of his thoughts. The coal men call him cranky, but they can't cheat Sol. out of a single bucket. He looks carefully at the tender before a new supply of coal is taken on, and by practice he can tell just how much has been delivered.

"Sol. had for a long time a fireman named Jim Winter, who was the reverse of his engineer in every respect, but they got on well together. Jim was a great talker, and it nearly killed him to make a trip without having anybody to gas to. He tried talking to Sol. on the road at first, but was sternly repressed. When he was not firing, Jim was on the lookout for something that he would like to talk to, and Sol. used to say that his fireman passed the time of day with every horse and cow seen by the wayside.

"When it came to be near Jim's time for promotion, the master mechanic asked Sol. if he would recommend his fireman for setting up, and was told 'No.'

"'What is the matter with him?' asked the master mechanic. 'I understood he was a steady young fellow. Is he a poor fireman?'

"'He is a pretty good fireman,' said Sol., 'but his mind is never on his work. He reads books and papers about locomotives, but his mind is never upon what the engine is doing when we are on the road. You may set him up, but I will not be responsible for him.'

"Jim was set up afterwards, and burned a boiler the second week he was running. The boys say that it happened through a little heart trouble. There was a girl in the dining-rooms at Springfield whom Jim was greatly stuck on, and this day he wanted to show himself off as a brand new engineer. Conductor Conway, the best looking and the emptiest-headed man on the road was at Mary's table, and she could not spare a look or a word for poor Jim. He was all broken up with this treatment, and took it so much to heart that he forgot to start the injector, and only came to himself when the lagging took fire. He is running a switch engine now and will never go higher.

"Uncle Sol. got into the way of running with very large nozzles. He said an engine did her work better when there was a big hole for the exhaust steam to escape by. Large nozzles were not common on the road and no other engineer could get her to steam if he had a fireman strange to the engine. They persisted in firing too heavy. The light exhaust would not pull air through a thick fire.

"When Jim first went firing for Sol., he wanted smaller nozzles. Jim liked to hear the exhaust ring out clear. He had heard other engineers say it was a sign that the engine was working. He believed also that the '299' would steam better if the nozzles were bushed. He kept up the song about bushing nozzles so persistently, that one day they were in the shop, Sol. agreed that he might take out the nozzles and have them bushed. After they were put back and Jim out of the way Sol. opened the smokebox door and pinched out the copper bushings and put them in his seat-box.

"When they went out next morning and were pulling out through the yard Jim said, 'Isn't she a dandy! Don't you hear her speak?'

"'Yes,' answered Sol., 'there's eleven cars behind her.'

"All through the trip the engine steamed splendidly, and Jim frequently mentioned that the bushings were doing it, and she was burning less coal than she had ever done before. Two or three days after Jim was looking in Sol.'s seat box for a headlight chimney and found the nozzle bushings.

"'What are these things?' he asked.

"'These are the bushings you had put in the nozzles,' said Sol.

"'But how do they come to be in your seat-box? When were they taken out?'

"'I took them out the day you put them in. When they were making the engine speak out, and making her steam and saving coal they were in my box all the time. That's the right place for them.'

"Jim looked sheepish but said nothing. The engine kept on steaming all right. There was never anything more said about bushing nozzles."

Want to Abolish Cab Seats.

The *Railway Age* has found a railroad manager who objects to the use of seats in locomotive cabs, and wishes to compel the men to stand while on duty, so that they may direct closer attention to their duties. We are not surprised that a railroad man could be found who would express sentiments of this character when he could do so without his identity being revealed; but we feel certain that no one holding a responsible position on a railroad is fool enough to publicly father any such sentiment. Probably some people would like to see our engineers compelled to stand while on duty, because "it is English, you know," and there are asses among us who are ready to worship any foreign fashion, no matter how absurd or how oppressive it may be. The *Railway Age* submits the question of seats or no seats in locomotive cabs as worthy of consideration from different standpoints. We say that it is puerile and senseless to attempt finding excuses for taking away seats and otherwise making engineers as uncomfortable as possible. There have never been any arguments advanced in favor of the barbarianism of English practice in this respect. Those who say that a comfortable seat encourages the engineer to sleep on duty do not know what they are talking about. Men with sense do not sleep in the cab; but if a man has strong inclinations in this direction, he learns to sleep standing as well as the same class of men provided with a seat goes to sleep sitting, unmindful of the responsible duties intrusted to his care.

The mechanical engineers of England who designed the equipment of the early locomotives, had no experience in the handling of the engines in all kinds of weather, and they had no sympathy with the hardships enginemen have to endure. They asserted that enginemen were no more exposed to the weather than stage coach drivers were, and so no cabs or shelter were provided. The first locomotives had very small foot plates, and seats were not provided because room was scarce. This led to the practice of making the enginemen stand. When engines became larger, and there was plenty of room for seats, the fashion of standing had been established, and a new mental dispensation for designers is required to change anything that has become a mechanical fashion, no matter how absurd it may be. When the British brutal treatment of enginemen was taken up by humanitarians and discussed by the press more than thirty years ago, the men responsible invented the excuse that making enginemen comfortable would encourage them to sleep on duty or to neglect their duties. This has been the defence of the practice ever since. There is nothing in it.

The writer passed seven years on the footplates of British locomotives, and about the same time in the cabs of American locomotives. The teaching of this experience is, that a comfortably housed engineer can attend much more closely to his duties than one standing exposed to the weather. The British engine driver is too often engaged trying to escape discomforts which distract his mind from the working of the engine. An engineer who is overcome—prostrated with fatigue—is a dangerous man to be in charge of an engine. In that condition it is physically impossible for him to devote close attention to the numerous duties devolving upon him. A man standing gets worn out much more quickly than one sitting, which is good and sufficient reason why good, comfortable seats should be provided.

A Roundhouse with an Educational Attachment.

Mr. Whalen, roundhouse foreman of the Chicago & Norwestern shops, at Chicago, has fitted up one of the stalls of the engine-house with a variety of educational appliances which are greatly appreciated and used by the enginemen and ambitious machinists belonging to the road. The most prominent of the apparatus is one of the LOCOMOTIVE ENGINEERING valve motion models. This has been used so much that it broke down, but was promptly repaired. Some one appears always to be trying to find out something concerning valve-motion by the use of this model. There are on all railroads men who pretend to profound knowledge of valve-motion, and these are generally wanting changes made on their engines to conform to their ideas of what will secure improved distribution of steam. When any of these men belonging to the Northwestern wish to have their valve-motion changed, they are invited to come round and demonstrate on the model the improvements they propose to be effected on their engines It is generally found that the graphic showing which the model produces leads those demanding changes to modify their views. After they wrestle with this tell-tale machine for an hour or two they conclude to call for no changes, or at least to wait until they have time to study up the matter a little more.

In addition to the valve-motion model, there are sections of injectors, engineer's valves, triple-valves, lubricators, and a variety of other things which are calculated to impart valuable practical information to the men handling or repairing the appliances When the foreman sees anything that has caused any apparatus to act badly, it is taken and placed in this museum as an object lesson. Among the object lessons we found on the table were injector-tubes filled up with lime deposits, lubricator-feeders filled up with incrusting matter, bent reversing-rods of air-pumps, etc. Men examining these things quickly understand how they get out of order, and are able to report more intelligibly about defects of their apparatus.

Mr. Whalen says that the educational effect of his museum has been of great benefit to the company. Men used to come in and report "air-pump to be examined, injector working badly, lubricator out of order," and so on. Very rarely was information given that would enable a machinist to identify the defect. This led to much useless labor searching for what was wrong. Since they began studying the apparatus provided, the engineers nearly always report in a way that indicates what is the matter They are very rarely mistaken. This provision for obtaining correct information leads to great discussions among the enginemen, and they arrive much more closely to the truth than they formerly did.

The Hobbs Island Transfer.

At the December meeting of the Engineering Association of the South, Mr. G. D. Hicks, division superintendent Nashville, Chattanooga & St. Louis Railway, presented a paper on the Hobbs Island Transfer, from which the following is condensed

"Hobbs Island and Guntersville, Ala., are twenty miles apart, on opposite banks of the Tennessee River, and on one of the lines of the Nashville, Chattanooga & St. Louis Railway. This gap is closed by the Hobbs Island Transfer. The transfer plant consists of two stern-wheel steamboats, of 40 and 90 tons burden, and two double-track barges, one for four cars and the other for six cars; the lighter boat conveys the passengers, and the other one, with the barges, the freight. Time, Guntersville to Hobbs Island, about two hours for the passenger boat and two and a half hours for the freight

"At each of the termini is an incline, at the foot of which is a cradle, movable along the incline, so that cars can be run upon the barges at all stages of the water. The river has a rise and fall of 40 feet at Hobbs Island and 47 feet at Guntersville. The grade of the incline is $3\frac{1}{2}$ per cent. and they are on earth fills, pile trestle, rip-rap bank and a crib at the bottom, where the nature of the river bed prevented driving piles. The incline at Guntersville is, in part, on a 10° curve. The cribs are built of 12 x 12-inch timbers, loaded with stone. The cradle at Guntersville is novel, in that it is constructed to run on the 10° curve as well as on tangent. It consists of eight sections on wheels and two sections on slides, the first section carrying a 20-foot apron and the last a feather rail. The sections are not rigidly connected, but by a bolt, allowing about 5 inches play. The rails are laid with opposite joints, spiked only at the joints and held together by tie-bars. The rails outside on the curves are $1\frac{1}{4}$ inches longer than those on the inside; on tangent each opening thus formed between the shorter rails is closed by a short section of rail, inserted and held by a split key passing through its web and the splice plates. The bolt holes in the rails are slotted. The cradle at Hobbs Island is on a tangent. The cradles are moved along the incline by locomotives or a boat.

"The connection between the apron and the barge is unusual. The ends of the rails on the apron are turned outward about 30° at the junction, while the ends of the rails on the barge are beveled to the same angle. The latter are held by tie-bars, one of which nearest the beveled ends has a turnbuckle. Just back of this rod a lever is arranged to lift the beveled rails clear of the apron, till the windlass has drawn the nose on the barge into the V on the apron, the gauge having been lessened by the turnbuckle. Then the beveled rails are lowered into place and the gauge restored by the turnbuckle, making the rails continuous from the barge to the cradle.

"The cost of the steamboats and the barges was $30,368; the cost of the crib and cradle at Hobbs Island $4,343 and $837, respectively, and at Guntersville $3,045 and $961, respectively."

In the days not long passed, when broken chilled wheels were keeping the ditches of certain railroads full of wrecks, the wheels that caused most of the damage were known as seven dollar wheels. Honest material could not be put into wheels and sold at that figure, so it was well understood that the money paid represented the most dangerous wheel in the market. The seven dollar wheel has again come into favor with certain purchasers, and of course, the supply is equal to the demand. The agent of a maker of cheap wheels recently heard of a railroad company which was prepared to place an order for wheels to the lowest bidder, and he went to the purchasing agent with his seven dollar invitation to calamity. Imagine his surprise when he was told that his price was too high and that an offer was in to supply wheels at five dollars and twenty-five cents. They were bought for that sum, too. We believe this is the lowest point ever reached, even for the worst quality of wheels.

There is no line of invention receiving more attention at present than the producing of an angle-cock for the train-pipe, which will perform its simple functions and yet be of such form that it cannot be turned to cut off communication between the engine and the greater part of the train. Angle-cocks of special form are passing through the Patent Office in great numbers, but most of them have objectionable features. We believe that an invention has been perfected by Mr. A M Waitt, superintendent of the car department of the Lake Shore & Michigan Southern, which will put an end to the inventing of improved angle-cocks. In a ridiculously simple manner he makes the common angle-cock perfect. By an attachment which can be put on for about fifteen cents, he provides means to notify the engineer if the angle-cock is turned. We are not at liberty to give particulars. This much-needed improvement was proposed by a car inspector and the details worked out by Mr. Waitt.

A circular issued by President Ingalls, of the C., C., C. & St. L., says "The transportation department, through the general superintendent and superintendents of divisions, will have full control of all work and employés engaged therein which is charged to conducting transportation. Master mechanics will report to the superintendents, instead of to the superintendent of motive power, in all matters charged to this account. This order is issued for the purpose of enabling the superintendents to have full and complete control of all matters and expenses charged to the accounts which they are responsible for, and to relieve the superintendent of motive power of so much detail work. For convenience, storehouse supplies will be kept at Brightwood, and employés engaged in handling same will be under the supervision of the superintendent of motive power, as heretofore."

We have recently received particulars of a peculiar wreck. The rear sleeper on U. P. train No. 1 was wrecked on January 9th, at Clark's, Neb., in the following manner The truss-rod of the sleeper ahead broke and caught the head-rod of the switch, buckling it so that it pulled the point open, letting the car "San Antonio" off the rail and up the siding. Car ran about 450 feet, and turned over an embankment about 4 feet high. The car caught fire from the oil lamps, and before the trainmen could get action on the fire from the lamps, it had gained such headway as to be beyond control. The car was totally destroyed.

The Railway Times is the name of the new official organ of the American Railway Union. It is at present a six-column four-page paper, published every two weeks. The officers of the Association do not intend to publish a monthly magazine, but to gradually shorten the interval between publication days, until the *Times* becomes a daily. There seems to be some demand for a labor daily, and the *Times* proposes to fill that demand. The subscription price is at present $1 per year. The Union seems to be gaining lodges and membership fast.

A most interesting paper on "Metal Under-framing for Freight Cars" was read before the New York Railroad Club at the January meeting, by Mr. G. R. Joughins, superintendent of motive power of the Norfolk & Southern road. They have in use there a car of their own design that carries 80,000 pounds with ease, and which shows that metal frames can be bolted together and give no trouble in service, the car having run fourteen months without a bolt loosening, yet there are no check nuts nor are the bolts riveted down

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If we are to judge from the way railroads are managed in China, that country appears to be a perfect paradise for office-seekers. There is now in operation about 120 miles of railways in China, and about 30 miles of this is operated by the government. To do the work there are already in the head office about one hundred clerks, most of them forced into position by importunate politicians.

The English locomotive, "James Toleman," exhibited at the World's Fair, has been in use on the Chicago, Milwaukee & St. Paul for several weeks. The engine hauls a good train so long as the steam lasts, but that is only for a very short time. The four cylinders in use very quickly empty the boiler, and then the engine has to stand until she has time to boil more water.

A new 8-wheel locomotive is under construction in the Union Pacific shops, at Armstrong, Kan., and the railroad men of the place are predicting that the engine will be a little better than anything of the kind owned by the company. The cylinders are 18x26 inches, driving-wheels 69 inches in diameter, boiler of steel, $\frac{9}{16}$ inch thick, to carry 180 pounds pressure.

The engineers and firemen who struck on the Lehigh Valley Railroad are very much dissatisfied with the settlement made. Only about half of the old men have obtained jobs, and many of those have been put on inferior runs.

T. Hackworth Young, late assistant to the Chief of the Transportation Exhibits, World's Fair, has accepted a responsible position under Mr. F. W. Johnstone, superintendent of motive power of the Central Mexicano.

The *Locomotive Engineers' Journal* has a bright new cover and more illustrations than usual. Brother Hays deserves credit for the improved appearance of the journal

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We cannot change advertising after the 15th of the month. Advertising matter, except cover, goes to press on that date.

*Diseases of the Air Brake System; Their Causes, Symptoms and Cure.

By PAUL SYNNESTVEDT.

Governor.

(18.)

Before considering the diseases to which the governor is subject let us say a word about the use for which it was designed. This will assist us very materially in treating any difficult cases.

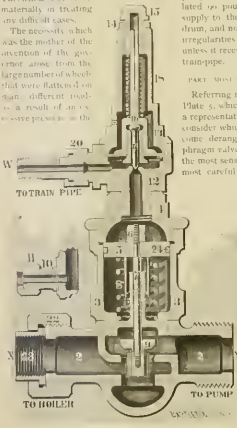

Plate 5. Westinghouse Old Style Plate D.

The necessity which was the mother of the invention of the governor arose from the large number of wheels that were flattened on many different roads as a result of an excessive pressure in the train-pipe. This was the primary cause. Other causes there were of less importance, among them being the need of some device which would prevent, as far as possible, needless wear of the pump and waste of steam.

A governor is a throttle-valve for the pump, operated automatically by the air pressure. There are many different styles in use, but they all operate on the same general principle.

There is a steam-valve in one end which controls the flow of steam to the pump, and is attached to a piston in such a manner as to be operated by the piston in shutting off the steam to stop the pump. The other part of the governor is a kind of a safety-valve which controls the opening from the source of air supply to the piston which operates the steam-valve. This safety-valve is held shut by a spring under adjustable tension, and when the air pressure accumulates to a sufficient degree to open the safety-valve the pressure which escapes passes to the piston cavity, and forces the steam-valve shut, stopping the pump. When the air pressure is reduced the safety-valve closes again, and the air which is holding the piston against the steam-valve leaks by till the valve opens and allows the pump to start again.

DIAGNOSIS.

The first thing to notice about a governor that is not working properly is the air connection. Find out whether it is made to the train-pipe, main drum or some other place, as this has a great deal to do with its action. It cannot be expected that the governor will stop the pump when the main drum has accumulated 90 pounds pressure unless the air supply to the governor comes from the drum, and no governor can be blamed for irregularities in the train-pipe pressure unless it receives its supply of air from the train-pipe.

PART MOST LIABLE TO GET OUT OF ORDER.

Referring now to the governor shown in Plate 5, which in general construction is a representative of all three shown, let us consider which parts are most liable to become deranged. First of all, the diaphragm valve 17 with its co-acting parts is the most sensitive, and should receive the most careful attention. The accumulation of dirt around the small seat of this valve is the only trouble with many governors reported defective.

CARRIES TOO MUCH OR TOO LITTLE AIR.

This may produce either of two opposite effects. It may cause the pump to stop at too low a pressure from holding the valve open, so that the air constantly leaks through, or, if the dirt be gummy or sticky, it may accumulate in such a way as to gradually decrease the opening or lift so that the pump will accumulate too much pressure.

SLOW IN LETTING THE PUMP START.

Sometimes it has the effect of so reducing the sensitiveness of the governor that a reduction of several pounds may be necessary in the air pressure before the pump will be permitted to go to work again. That it is necessary for a governor to work very sensitively is something that is not understood by many air-brakemen, and yet if a governor does not meet this requirement it will give a great deal of trouble in service from sticking of the brakes or loss of excess pressure where the connection is made to the train-pipe.

RELATION OF GOVERNOR TO EXCESS PRESSURE.

Many men may want to know what the governor has to do with the excess pressure when the connection is made to the train-pipe and not to the drum. Let us consider a common difficulty in service that will help to make this point clear. Frequently, on the road, when the engineer's valve handle is in the running position and the main drum has 90 pounds and the train-pipe 70 pounds pressure, with the pump stopped, the excess pressure will gradually begin to disappear, the red pointer or main drum pressure sometimes falling a little below the black one, till the black one begins to fall with it and the brakes set and drag before the pump can get to work and release them. Of course, it may be said that this trouble is due to leakage, and so it is, but the fact remains that if the governor were in proper shape it would not occur. Some leakage is unavoidable, such as will be lost through bell ringers, sanding apparatus or other auxiliary devices attached to the air-brake system. The case described just above is most liable to occur on trains where there is little leak in the train pipe, for a heavy leak in the train-pipe would not permit the pump to stop.

BUCKLING OF DIAPHRAGM.

Another part liable to get out of order is the soft metal diaphragm 19, which sometimes gets loose at the edges, or "buckles." In the experience of the writer, however, this is not of very frequent occurence. Altering the length of the valve 17 is a very bad thing to do, as it may get so short as not to seat at all, causing the governor to throttle the pump all the time at about 40 pounds. It is better not to take the valve 17 out at all if it can be avoided, as a leak out of the vent-hole in the upper casing will be very apt to result if the nut that holds this valve does not screw back to exactly the same position.

BUZZING.

Splitting the stem 16 was done to prevent the buzzing or rattling noise the first governors made, and this practice is still followed, though it was afterward found that the cause of the noise was the lack of a packing ring in the piston 5, which was omitted in the earlier construction. The author thinks this split stem interferes a little with the sensitiveness of the governor if it is spread at the top, and would recommend that all such be straightened and trued, so as not to bind in the nut.

REFUSES TO STOP PUMP.

If the governor is entirely inoperative—that is, does not stop the pump at all—the trouble may be found to be due to one of several different causes. Either the small vent hole in the side of the cap 13 may be stopped up, permitting the accumulation of back pressure above the diaphragm, the exhaust stud 10 may be stopped, the piston 5 may be stuck in some manner, or the brass backing above the diaphragm 19 may be too thick, preventing the valve from raising.

FREEZING OF EXHAUST.

Cases are not infrequent where, in very cold weather, the exhaust-pipe leading down from the stud 10 has become frozen solid, the train-pipe pressure accumulating to over 90 pounds before the engineer discovered that the governor had ceased to act. This is a difficulty very hard to locate, as it thaws out when the engine is brought into the house, and then, of course, the governor works all right again.

LOCATION OF GAUGES.

Many gauges are placed in such a position that they cannot be seen at night, and in such cases failure of the governor may slide many wheels before the engineer finds out that his governor has stopped working. No engineer can take time to get up every few minutes and light a match to see how his air pressure stands. He has other things to do.

BINDING.

As to the lower part of the governor, see that the rod 7 and piston 5 fit well and still work freely, and do not have the packing ring 24 too tight a fit, else the governor will not open promptly.

MASON REGULATOR.

The Mason regulator is shown in Plate 7 (*a*). As its principle of operation is quite different from those previously described, we treat of it here under a separate head. The general distinction may be stated to be that in this one the operative fluid pressure (that which moves the piston to stop the pump) is *steam* brought into play, of course, by pressure from the train-pipe, while in the others the train-pipe pressure itself acts directly to close the main valve. In examining one of these governors out of order, however, we have to begin with the same general diagnosis as was used in the other cases. That is, note whether the difficulty is too *much* or too *little* air pressure, or whether the pump is stopped entirely.

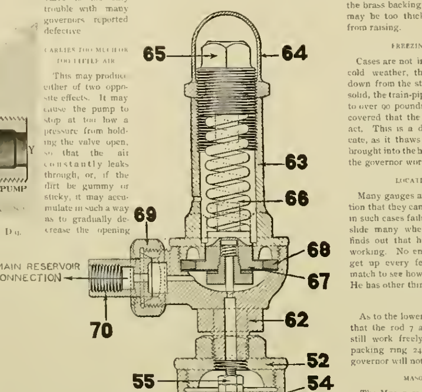

Plate 6. Westinghouse Improved.

TOO MUCH AIR.

If our case is one in which the governor refuses to stop the pump when the desired

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pressure has been reached, we can conclude that something is holding the main valve 21 open. This may be dirt under the seat of this valve, boiler scale perhaps, or what is much more probable, it may be steam pressure under the piston 19. If this be the case, it is very evident that the auxiliary valve 8 is not seating properly, for if it did no steam could then get under the piston 19.

This will generally be found to be the cause of this trouble, for this valve, being smaller and more delicate than the main valve 21, will naturally be more sensitive to dirt and need more frequent attention. To get the valve 8 out, proceed as follows

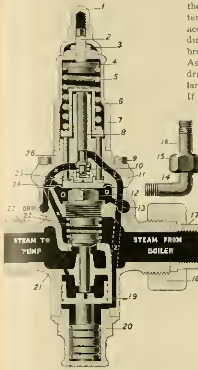


PLATE 7 *a*. MASON REGULATOR.

Shut off both steam and air. Remove the cap 1, and unscrew the adjoining screw 2 until all tension is removed from the spring 5. Take out the screws 9 and remove the bonnet and diaphragm, when, by unscrewing the nut 25 and lifting out the small spring, the auxiliary valve 8 may be reached. This valve should work with considerable freedom, and have a good tight seat

TOO LITTLE AIR—PUMP STOPPED.

If the pump stops, and the regulator will not let it go to work again, it is very clear that for some reason or other the main valve 21 has failed to open, and some defect must be holding it, or rather the piston 19 which operates it, from moving. This piston is intended to be moved by steam pressure through an opening controlled by the auxiliary valve 8, and it is possible this valve is stuck shut, or, for some reason, refuses to let the steam pass. Corrosion, from standing long without use, might cause much trouble. Another thing which might interfere with the opening of the main valve 19 would be a binding of the piston 19, or its dash-pot extension. Sometimes variation in expansion from the heat of the steam will cause such trouble. Of course, the proper remedy for this is to take the piston out and reduce the size of it a very little, preferably with the use of emery cloth, so that it may work with perfect freedom when put back into place.

Main Drum.

The main drum is a very important although simple part of the apparatus, and one which seldom receives the consideration that it merits. It performs two separate and distinct uses. First, it acts as a storage reservoir for air to be used in releasing brakes or charging the train, and second, it is of great use as a drain-cup to free the air from water, oil or other foreign substances, particular care should be taken to have it located properly on the engine and to have the pipe connections properly arranged.

LOCATION

In order to act to the best advantage as a drain-cup it should be placed as low as possible, the best place where there is room enough, being under the forward end of the boiler. Sometimes it will fit better under the deck of the cab. Always avoid putting it on the tender, as such a location generally necessitates its being pretty high, and also requires the use of a hose connection in the pipe from the pump leading from the engine to the tender, and this will frequently rot out on account of the water and oil which come directly from the pump, rendering the brake entirely useless in case of a rupture. As to the storage capacity of the main drum, there is only one rule. Make it as large as possible The larger the better. If there is not room anywhere for one big one, put two little ones on and connect them with a large pipe. Great care should be taken to see that they can be both readily and *completely* drained, and this should be done as often as possible. Twice a week is not too often by any means

IMPORTANCE OF DRAINING.

Remember, there are two important reasons for this First, the water, if allowed to accumulate in the drum, will get into the triple-valves and interfere with their action, freezing them up in cold weather, and, second, the more water there is in the drum, the less room there is for air, and, consequently, the less pressure will there be available to release the brakes or recharge the train.

More than one runaway on a grade has been caused by water in the main drum, there not being sufficient storage room for air to properly recharge the train after the brakes are released There have been many cases of brakes sticking where there was no trouble at all with the apparatus itself, but simply too much water in the main drum.

It is hardly necessary to state that when a disease is as easy to cure or prevent as this one, there is very little excuse for its existence. Never stop to go through any brain-racking argument as to whether there is water in the drum, but go right to work and let it out. There is some water in *every* drum, and even if it is only a few drops, it never hurts to let it out. A few words as to where so much water comes from may not be amiss here. It is not, as many suppose, entirely the result of leakage past the piston-rod from the steam cylinder. In fact, comparatively very little of it is from that source. It is simply an unavoidable consequence of the compression of air.

SOURCE OF THE WATER.

All air contains moisture in suspension, and of course the more cubic feet of air we compress into one cubic foot the more moisture there will be in that one cubic foot, until, finally, it becomes so saturated that it will not absorb any more, and what surplus there may be is precipitated and collects in the bottom of the receptacle.

The pipe connections from the pump and engineer's valve should both be made near the top or highest side of the drum, so that any water that may collect in the bottom may not interfere with the flow of air through them. This is *especially* true of the pipe leading from the drum to the engineer's valve

LEAKAGE.

Besides water, about the only other trouble to which the drum is subject is leakage. To test this, the engineer's valve handle should be placed on the lap, when a falling of the red pointer on the gauge will be noticed almost immediately in case there is any leak

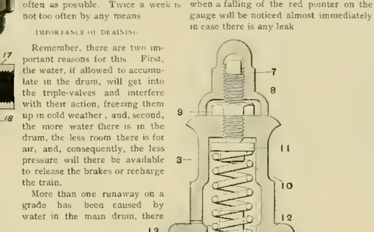


PLATE 7 NEW YORK GOVERNOR

These leaks are not often in the drum itself, but in the pipe connections from the drum to the pump or engineer's valve, frequently at the union next to the drum. A good deal of trouble will be experienced with leakage at this point if the drum or pipes are insecurely fastened in place, as the constant shaking will loosen the joints

Many engineers seem to think that a leak in the drum is not of much consequence. This is a very great mistake. It often causes sticking of brakes after the governor has stopped the pump. Even a small one should be properly attended to just as soon as possible.

*Railroad Coppersmithing—VI.

By JOHN FULLER, SR.

CHIMNEY TOPS.

Chimney tops, or tops of smoke funnels, Fig. 73, are made of copper usually, on account of economy, and because of the difficulty in making or forming them of sheet iron. A chimney top, if properly formed, adds much to the beauty of the chimney or smoke funnel. The bell curve should be elliptical, as shown in *C*, Fig. 73, similar to a cornet or trumpet; if it be made to a circular curve, it never looks well. I have heard many criticisms made by quite disinterested persons when new engines have been turned out of the shop or a new one brought from another factory, which has proved conclusively that where it is necessary to make curves or flourishes of a similar nature to that of a chimney top, those that please the practical eye the most are the ones made to or having elliptical curve. Let us suppose we have to make one of these chimney tops for a locomotive chimney, and let the bell or top diameter at *A* be 26 inches when complete, and have a half-inch iron ring for the crown plate to lay on and a half inch to turn over to fasten in the crown plate, and let the funnel be 14 inches in diameter at *B*, as shown in Fig 73 The pattern is the first thing in order, which is obtained in the following manner First draw the outlines or diagram of the top as it is desired to be when finished and shown in *D*, Fig. 74, making it 28 inches from *G* to *H*, thus extending the curve of the bell an inch each side for the purpose of making the necessary edge for closing in the iron ring and crown. Now divide the curves *G K* and *H N* into four equal parts, and through the upper and lower divisions *a* and *c* draw the lines *O F* and *O P*, letting them meet in *O*, then on the line *O F* from *R* lay off the length of the curve *H N* towards *F*, and with *O F* as radius describe the arc *F S T E*, making it three times *F P* in length, join *O R*, and with *O R* as radius describe the arc *R U*, then *R F S T E U* is the pattern required. From a sheet of copper of about 16 gauge cut out the pattern and round up the edges outside and inside, make the joint and solder it down. Now form it up and make true as in Fig. 75, and take it to the mandrel block, Fig. 76. Now divide the depth of the top into four equal spaces with a racer, Fig. 75, then with a ball-faced mallet, work out on the mandrel a course at the small end, now turn it end for end, and from the inside work out a course at the large end, then hang it on the mandrel and work in a course from the end divisions on the outside towards the center, Fig 77, which will complete the first course. Now anneal and proceed as before, first inside and then outside, until the proper curve has been given to the sides. Then put it on a former, that is, a cast-iron form made to the shape of the top, and about an inch thick, as in Fig. 78. The top is now annealed, scoured clean, and carefully dressed close to the former, and then planished smooth on the mandrel; after which the edge is turned up an inch at the large end to receive the iron ring and crown plate, and then handed over to the boiler-makers, who make and finish the funnel ready for the smokebox.

IRON COPING.

In the manner of dress, locomotive engines have had to keep time, like other things, with surrounding circumstances or the fashion set by some leading road or manufacturer. Sometimes they have been embellished with brass ornamental work, kept brightly polished; at other times, this same ornamental work has been painted and lined out. Then, again, the brass work has given place to sheet iron of similar form painted, and so changing to suit the fashion. The making of iron coping and brass moldings for finishing

*Copyrighted by John Fuller, Sr, Seneca, Kan These articles commenced in September, 1893 and ornamenting the lagging of locomotive engines is considered a first-class job, and only the leading workmen in a shop can safely be intrusted with the work, because if it be not artistic and skillfully performed, instead of completing the symmetry of the lagging and adding to its beauty, it is a blemish instead of an adornment.

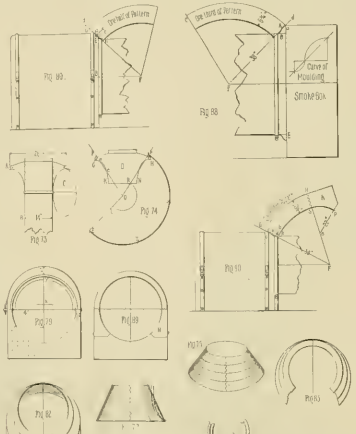
We shall first consider iron copings; because, while the two pieces of work when finished are very similar and for the exact same purpose, the manufacture of iron coping is performed quite differently to that of brass moldings. In England at one time a greater part of the engines had three copings or moldings to complete and give finish to the lagging; one next the smokebox, one to connect the lagging of the boiler to that of the firebox, and the other to finish out and complete the lagging at the back of the firebox, but when iron coping was used we seldom made but two, which were at each end of the firebox. These finishings are made of the best sheet iron that can be obtained, and are of about 16 gauge. Let us suppose we are making two of these iron copings to show the methods which have been used in preparing them, and we will take the one at the boiler end of the firebox first. The first thing in order is the pattern. Now, we will suppose the boiler with the lagging on it to measure 4 feet in diameter, and the firebox 4 feet 4 inches wide, with a 5-inch rise, that is, the crown of the firebox sheet is set up three inches out of the center as shown in Fig. 79 at *x*. Let the coping at *E*, Fig. 80, have a curve from the firebox toward the boiler, equal to a 3-inch radius, and a lap over the firebox of three inches, so that the band will grasp the coping well and bring it close, when finally drawn down by the bolt at the end of the strap shown at *E*. Let *a b* represent the curve of the coping equal to one-fourth of a 6-inch circle. The diameter of the firebox crown, including lagging, is 4 ft. 4 in. Divide the curve of the coping into two equal parts, as shown at *C*. Then through the points of division *a* and *b* draw the line *F d*, and let it pass through the center of the boiler at *F*. Now measure the distance from the center of the curve of the coping at *C* to the outside edge of the strap on the firebox and lay it off on *F d* toward *d*, also from *c* to the outside edge of the strap on the boiler toward *h*, then *G h* is the width of the pattern, which is found to be a little less than 11¾ inches, or, to be accurate, ¼ the circumference of a 6-inch circle equals 4.7124 and 3 inches for lap on firebox, 2 inches rise and 2 inches for strap on boiler, thus 4.7124+3+2+2=11.7124, now add ¼ inch for variation in working and trimming, and the width of the pattern *G h* is 12 inches. The radius of the pattern from *F* to *G* is 45 +, and the length of the pattern in the middle is one-half of the circumference of the circle forming the crown of the firebox lagging, that is to say, $\frac{52 \times 3.1416}{2} = 81.6816$. Cut out the pattern 81.6816 inches long in the middle as described and shown in Fig. 80, adding an inch for riveting, and file the edges up round and smooth and see that no cracks made by the shears are left in. Now form it up into a frustum of a cone and rivet it together with four rivets as in Fig. 81. The ends of this frustum are now to be drawn in (Fig. 82), sufficiently so that when it is opened out (Fig. 83) the firebox edge will stand at right angles with the boiler edge, and be the right size to fit the crown of the firebox lagging. To determine the proper size to raze down the ends, a little figuring is here necessary. Euclid says, and it has been proved true, that all circles are to each other as their diameter, here the diameter of the crown of the firebox with lagging added will be 52 inches, the depth from the crown to the boiler is 5 inches, add 2 inches for arch flange to set on the boiler for the band, making 7 inches, then the small circle of the coping shown by the dotted circle, Fig. 79, will have a diameter of 38 inches, or 52 less 14.

Now, if one-half the circumference of a 52-inch circle be brought together it will form a whole circle 26 inches in diameter, and this is the size the cone will be in the middle when formed up ready for working as in Fig. 81, and this gives us the key to the size the small end should be razed down to.

Therefore 52 : 38 :: 26 : 19; that is to say, the frustum of a cone must be razed in straight for 3 inches up at the base and at right angles with it, and 4¼ inches from the top end, and the remaining 4¾ inches curved between the straight parts at top and base, as shown in Fig. 82. Raze in the two ends, the base to measure 26 inches and the top end to measure 19 inches, and when they are the proper size anneal by making it a bright cherry-red heat and let it cool slowly. When cold, take out the rivets, Fig. 83, and open it out on a boiler-maker's slab until that which formed the small end of the cone lays flat on the slab, and that which formed the base stands perpendicular or at right angles with the slab on which it lies, Fig. 84. It will be found that the inner circle of the coping at *B* will now measure 38 inches or thereabouts, according to the degree of accuracy in the working, while the outer turned-up edge *C* will be 52 inches or the diameter of the firebox. Now round up to shape required, smooth and planish. This may be done with a suitable hammer, Fig. 85, from the inside in regular courses on a bottom steak or anvil, as in Fig. 86, or over a tee steak, Fig. 22. When the planishing and smoothing is completed, lay out the saddle flange which is to straddle the boiler and work it off to fit and trim it to the width of the strap, and the coping is complete ready for the lagging. If this work is performed skillfully, the coping will add to the beauty and symmetry of the lagging and make a nice, clean finish. The coping at the back or feed end of the firebox is made in the same way, of a suitable width, and the addition of legs as shown in Fig. 87, which are riveted on after the arch of the coping has been once fitted to its place.

BRASS MOLDINGS.

Brass moldings made for the finishing of boiler lagging has and gives quite a different appearance to an engine, and make them more attractive if the moldings are well made. We will describe the



manufacture of a set, and suppose we are required to make the two front ones in *O G* form by way of diversion, and give variety in method. Let it be required to make moldings to fit the boiler, as shown in Fig. 88, and to begin with the one at the smokebox end. Let the boiler with lagging be 48 in. in diameter, as before, and the molding made to cover the rivets and angle-iron, and let it stand out from the boiler 3 in., as shown at *E*. Then to obtain this pattern proceed as follows. Draw the curve at *A* with a radius of 2 inches, and the curve at *B* with a radius of 1 inch, and through the points *a* and *B* draw the line *d F*, meeting the center of the boiler in *F*. Now lay off from *B* the length of the two curves, *a A B*, on the line *F d*, toward *d*, which is equal to

$$\frac{2 \times 3.1416}{4} + \frac{4 \times 3.1416}{4} = 4.7124,$$

and from *B*, toward *F*, lay off the 2 inches for the band; then the width of the pattern will be 4.7124 + 2 = 6.7124 or 6¾ inches. Then with a radius *F a*, which will equal 38.18 inches, describe the arc *A C*, making it equal to 80, or one-third of the circumference of a 54-inch circle; then *A C* will be one-third the pattern required.

The pattern for the middle molding, Fig. 89, is obtained in a similar manner to that of the smokebox end, but it will be noticed in Fig. 90 the *O G* is both ends alike. To obtain this pattern, we proceed as before by taking a radius, *a c*, equal to 3 inches, and drawing the curve *c n* and radius *b d* also 3 inches; and drawing curve *n d*; then through the points *c n d* draw *G F*, meeting the center of the boiler at *F*. Now, on *G F*, from *n* and toward *G*, lay off the length of the curve *n c*, together with the width of the strap *a* or

$$\frac{6 \times 3.1416}{6} + 2 = 5.1416,$$

and from *n*, toward *F*, lay off the length of the curve *n d* and the width of the boiler strap *d*, also

$$\frac{6 \times 3.1416}{6} + 2 = 5.1416,$$

then adding these together, we have 5.1416 + 5.1416 = 10.2832; add ¼ inch for variation in working and trimming, and our pattern is 10½ inches wide. Now, with a radius, *F G*, equal to 58 inches, describe the arc *G H*, and with *F R* equal to 47½, describe the arc *R S*, making the pattern one-fourth the circumference of a 54-inch circle in length, from *G* to *H*. Now add the piece *K* to form the leg *N* shown in Fig. 89 (which turns the corner as far as and in line with the strap, and is held in position with set screws, as shown), and this half of the pattern is complete, ready for brazing together.

The pattern for molding at the back or feed end of the firebox, Fig. 91, is obtained in a similar manner to the other two which I have been here describing, and I leave this one to the learner, to exercise his perceptive ability, as well as to avoid repetition. We will now proceed to braze these pieces together and then work them up.

The Interstate Commerce Commission report for the year ending June, 1892, gives the following as the public service of the railroads of the United States: "The total number of passengers carried by the railways during the year was 560,958,211. Passenger mileage during the year was 13,362,898,299, and passenger train mileage 317,538,883. The average journey per passenger was 23.82 miles, and the average number of passengers per train for each mile run was 42. The number of tons of freight reported by the railways as carried during the year was 706,555,471. Ton mileage was 88,241,050,225. Accepting these figures, it appears that the average haul per ton was 124.89 miles. The freight train mileage during the year was 485,402,369, and the average number of tons per train for each mile run was 181.79 tons."

The Consolidated Car-Heating Co., of Albany, has begun suit in the United States Circuit Court against the Chicago & West Michigan Railway for infringement of the Sewall coupler patents.

In January number, page 13, second column, second paragraph, sixth line, read "60 feet," instead of "69 feet; in third column, second paragraph, twelfth line, read "friends of," instead of "friends with."

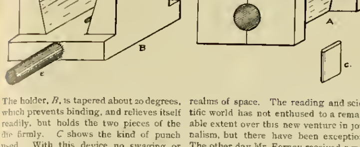
Several correspondents have asked lately, which of two engines, giving sizes and sometimes stating that one is a compound, the other not, will steam the best. No one can answer such questions from data.

We have been swamped with subscriptions and calls for charts, but are on our feet again, now. Commence your orders with January if possible.

Die for Punching Keyway in Tail-Bolts.

The attached sketch shows a good tool for punching holes in draw-bar tail-bolts with steam hammer, as designed and used by John H. Hughes, foreman smith of the Jacksonville Southeastern shops, Jacksonville, Ill.

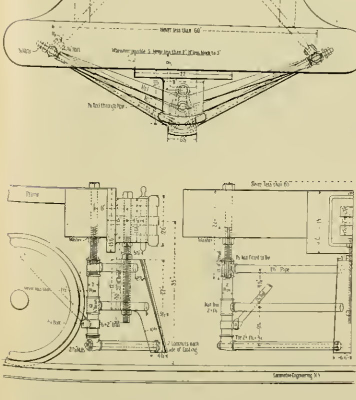
The die, *A*, is in two parts as shown.



The holder, *B*, is tapered about 20 degrees, which prevents binding, and relieves itself readily, but holds the two pieces of the die firmly. *C* shows the kind of punch used. With this device no swaging or drifting of the hole is necessary, as the pin is kept perfectly straight and smooth. A piece of gas-pipe with a tee on the end in which a wooden handle is placed is attached at *E*, and swung to the hammer to facilitate handling.

An Abbreviated Pilot.

Mr. John Medway, superintendent of motive power of the Fitchburg road, has lately put what he calls an "abbreviated" pilot on some of his engines. We illustrate the design herewith.



This pilot is very convenient on freight engines, as it requires no shackle-bar to couple to cars, and there is no danger to brake-beams when coupling. It is easily adjusted vertically, is safer than a pilot in case of collision—hardly enough of it to do much damage. The ordinary rear draw-bar for tenders is used, and the total cost for labor and material is only $7.80. In a country where there is very little stock we see no reason why it won't do well.

The Indorser Was Not Good.

We have already mentioned that Mr. M. N. Forney, the well-known railroad journalist, has extended the field of his labors and undertaken the editing of *Aeronautics*, a journal devoted to ballooning, flying machines and kindred methods of transporting men and things through the aerial realms of space. The reading and scientific world has not enthused to a remarkable extent over this new venture in journalism, but there have been exceptions. The other day Mr. Forney received a most enthusiastic letter from a gentleman in an inland city commending *Aeronautics*. Mr. Blank's son-in-law, who is an engineer, had seen the paper mentioned in LOCOMOTIVE ENGINEERING, so he advised the old gentleman to subscribe for it. On examining the first number, he wrote to Mr. Forney in the tone mentioned, adding that he intended advising all his neighbors and acquaintances to subscribe for the paper and read it. He considered it was the most progressive paper of the day and deserved to be zealously encouraged. Anything that he could say or do for the paper would be a labor of love.

Mr. Forney was delighted when he read Mr. Blank's letter, and, inspired by the true editorial spirit, determined to make use of it as an advertisement. Before doing so, however, he decided to find out the business followed by the gentleman who so heartily recommended *Aeronautics*. The letter is not likely to pass through the typesetter's hands in a hurry, for to his disgust Mr. Forney learned that the man who was so anxious to encourage air navigating literature is an undertaker.

Only a Picture.

BY J. F. HOLLOWAY.

It was a little thing—simply a small picture of an old-style locomotive placed in the middle of a page of a technical journal. When I saw it I was impressed with the idea that there was something about it that seemed familiar, and I looked all over the page on which it was printed, as well as on several adjoining ones, for a description of the engine, some statement as to what it had accomplished, some story of the men who had built it, and of the shops in which it had been made; but there was nothing to be found anywhere, only the picture and a line below it which read as follows: "Old Cuyahoga Engine, Built at Cleveland, Ohio."

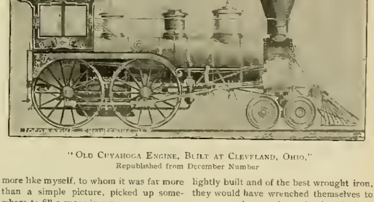
As I studied the picture from the foremost peak of the pilot to the step leading up into the cab, and from the truck wheels up to the top of the wood-burning stack, the thought came to me as to how many other eyes than mine had looked upon this little picture of the "Old Cuyahoga Engine," and I wondered if out of the thousands of readers of the paper wherein it was printed, there might not be one or more like myself, to whom it was far more than a simple picture, picked up somewhere to fill a space in a page.

To the vast numbers who saw it, it was simply a picture of an "old Cuyohoga engine, built at Cleveland, O.," and nothing more, no interest would be awakened by it, no comment evoked except perhaps to say how old-fashioned it is, and what a big smokestack it has, and how light it looks. Almost, if not quite in the belief, and certainly in the hope that the sight of the picture brought back "old times," at least to some who had looked upon it, I am inclined to talk with them about the old engine, the shops in which it was built, and of the men who were in them; and if there are those to whom the story will be of little or no interest, this is the place for them to switch off and lay down the paper. I have at times seen on the streets of New York elderly, gray-haired gentlemen who now and then, and especially about Thanksgiving time, gave an extra erectness to their forms, and a quicker, firmer action to their feet as they walked, and talked about old Yale, or old Nassau, Harvard, Brown or some other famous institute from which they had graduated long ago, and of which the flying colors and the noisy parades of the day brought back old-time memories, and I honored them for their newly awakened enthusiasm.

But, it was the little picture of the old locomotive that did the business for me, it was that which carried me back to the long ago, for I was a graduate from the "old Cuyahoga shops" years ago, and so was Billy Smith; and somehow it seemed to me that Billy must have seen the picture too, and although we have not seen each other for many years, I have a fancy that he will sometime or other see what I have written, and so it is to Billy, more than to any one else, I address myself.

It was way back in the fifties that the engine was built, in what was then one of the neatest and prettiest towns on the banks of Lake Erie; and Billy and I were young chaps then, working in the "old Cuyahoga." Elisha Sterling was the agent and business manager; and W. B. Castle, afterwards mayor of Cleveland, was the accountant and secretary; and Ethan Rogers was the man who did the designing and made the drawings. Who the bosses in the various shops were, you well know, Billy.

The pictured engine might be the "Reindeer," "Antelope," "Leopard," or any other of the fleet engines designed by Rogers, but no matter which one it was, it was, in its day, a beauty and a runner. It looks light, the engineers of to-day will say. Well, it was light, and fortunately so, for the road on which it had to run was made of light iron rails, in many places spiked to slabs that lay on the top of the ground, with neither ballast under them or ditches beside them, and many a time did the engines come into the roundhouse after heavy rains clay-washed from truck to top of smokestack. These new roads were not only unballasted, but they were so uneven that had not the engines been



"OLD CUYAHOGA ENGINE, BUILT AT CLEVELAND, OHIO,"
Republished from December Number

lightly built and of the best wrought iron, they would have wrenched themselves to pieces on the rough roads they had to travel on.

Those were pioneer days for railroads in Ohio, the few and newly-built roads were mostly through the woods and swamps, having a single track, with infrequent sidings, but with plenty of wet-wood stations in the winter and plenty of dry-water stations in the summer, and telegraph lines at no time; but the engines—they were daisies. Billy, you would have known that was a picture of a "Cuyahoga engine" if you had seen it in Timbuctoo, wouldn't you? That light, slender-looking frame was forged by Henry Trautman down in the old smith-shop, and you knew the fellow who blew the bellows, and the strikers that worked on the big fire; and you remember when they "jumped" the jaws on the frames, how all hands were ranged about Henry's fire to do something or other; and you know, too, that so well was the work done that never a frame was lost, or a weld came apart, after leaving Henry's anvil.

I suppose, if any of the engineers of to-day, the fellows who run the big moguls, or the consolidations, or the flyers on the Limited should happen to see the picture, they would wonder among themselves what that curved arm near the air-chamber of the pump was for, that is if they happened to know that pumps were at one time used on locomotives, and they would wonder why two valve stems came out of the steam-chest. But you and I know that the curved arm worked the independent cut-off valve that Rogers put on the "Cuyahoga engines," and which helped to make them famous in their day; for the vim with which they would start a heavy train, and the economy with which they used steam while under way, used to astonish the down-East engineers who [illegible] came out West with their heavier built engines.

Many and long were the disputes and discussions had between the men who used to run and swear by the "old Cuyahoga engines," as to their superior merits as compared with engines brought from the Eastern shops, and run on the same or adjoining roads, and oddly enough did they settle it. When differences now exist as to the superiority of one make of locomotives over another, the settlement of the question is left to scientific experts, who are usually professors of mechanical engineering in some college or technical school, who proceed to lash a student to the front of the engine, one on each side of the cow-catcher, furnishing them with levers, pulleys, strings, indicators, stop watches, etc., with instructions to take cards from the two steam cylinders under the varying conditions of load, speed and grade, and who come back from the trip with their hair full of dust and cinders, their faces marked with grime and their hats full of slips of paper covered with curved lines, all widely differing from Hogarth's line of beauty. Over these curved lines grave professors would then solemnly ponder, accounting as best they might for their sinuosity, and guessing at what they could not explain, after which, with the aid of planometers, scales and logarithms, they figured out that one engine was better than the other.

Not so were settled the questions as to which locomotive could pull most, steam better, run faster or hang on the longest in the days in which flourished the "old Cuyahoga engines." There were good talkers among the runners of those days, who were not afraid to express in language often more expressive than polite what they thought in favor of their own engines or in disparagement of others, and many a summer day was made warmer as a group of engineers on the shady side of the roundhouse whittled, bragged and bantered each other. Once after an unusual warm debate over the performance of a newly-arrived Eastern engine, as compared with a pet engine built at the "old Cuyahoga," it was decided to have a trial of the two engines in order to settle the matter.

The consent of the master mechanic having been obtained, a trial was arranged which in every respect differed from the trial trips as now made and as before described. What they wanted to know was which of the two engines, having the same quantity of wood and water, could go the farther on the same day, and over the same track. So it was arranged that the "Cuyahoga engine" and the Eastern or Yankee engine, as it was called, should both start on an equal footing from Columbus, and run as far as they could towards Cleveland without replenishing. It may well be understood that each engine was put in the best possible trim, and each engineer and fireman was at his best. Along the line at every town were gathered the railroad men, from the woodsawyer to the station agent, to greet and cheer their favorites as they rolled along northward, until, at last, the Eastern engine struck the descending grade several miles outside of Cleveland, and by its aid managed to crawl into the depot, bereft of wood, water, and steam. Then the query was, where was the "Cuyahoga engine" of which so much was expected, had it gone dead and cold somewhere back in the woods, and would another engine have to be sent out to drag it in, lifeless and disgraced?

For a while it looked blue for the Cleveland boys, but not long, for soon their pet engine was seen bowling down the grade, and as it neared the depot the crowd parted to clear the track, when the engineer motioned to open the switch leading to the Lake Shore track, then, with a defiant blast of victory, it dashed between the long line of spectators, turned its front towards Buffalo, and, climbing the heavy eastward grade, the backwoods engine rolled on and never stopped until it reached Painesville, thirty miles away, and, like Sheridan, won the day. Such a test would not at this time be deemed at all scientific, or perhaps satisfactory, but it settled the disputes years ago when that trial trip was run from Columbus to Cleveland.

The shops from which these engines came, were the first in which locomotives were built in the West, and they had few or none of the appliances with which the present locomotive works are so well supplied. They were situated on the banks of the Cuyahoga river, with no tracks near on which to place the engines after they were completed, and many a man would have shaken his head had he been asked to build engines in such a shop and with such tools, and then have been obliged to take them over a rickety pontoon bridge, in order to deliver them on a railroad track, but Ethan Rogers had the genius to manage it, and the pluck to dare it.

What a time it used to be, Billy, when it was noised about town that Rogers was going to take a new locomotive over the bridge, and what a job it was to get it up

"The Muley Cow," Cinder, Smoke and Soot Burner.

out of the yard onto the street and to turn it around there on an improvised turn-table. After this was accomplished, long timbers were laid across the old pontoon bride and a short distance on the opposite bank, in the meantime steam had been raised in the boiler, and the crowd of spectators driven from off the bridge, and the street cleared for a run which might result in reaching the other side, or in sinking bridge and all to the bottom, just as luck, or skill, and the coolness of Rogers at the throttle might decide. At last the decisive moment would come and with a shriek that might indicate defiance or despair, the throttle is opened and the engine makes a dash at the bridge which, feeling its weight, begins to sink deeper and deeper, as the spectators hold their breath and wonder why he don't go faster, but Rogers has done it before, and he will do it again. Nearing the opposite end of the bridge, with the water behind him awash on the pontoons, and the sinking track showing a sharp upgrade before him, he pulls the throttle valve to its widest notch, and the spurred engine, leaping as if for life, with a breathing exhaust that tells of the struggle it is making, climbs up from off the sinking bridge, landing on the bank safe and triumphant. Then, as the cheers rising from a thousand throats die away, the shrill whistle of the engine answers back till all the valley rings with its echoes. But Billy, the man who designed, and the men who built the engine we saw pictured, are all dead and gone, the stalwart smith who forged its frames, the men who molded and cast its cylinders and wheels and bored and turned its various parts, and who fitted up its rods and set its valves, have passed away, and I doubt if even a single engine remains to show what they so well did back in the fifties, with but few tools to help them. And Billy, you and I, who looked upon the little picture and found in it so much of interest, can hardly expect that it will interest any one else who may by chance have looked upon it, for it will have no story for them, there will be no memories to be awakened by it, no recalling of youthful days or of the men you and I looked up to as being such great men, such famous engineers, and such skillful workmen. But, Billy, if the little picture and what I have written about it, has brought such memories back to you, if it has recalled incidents well-nigh forgotten, faces that had faded from your memory, or if it has brought back to many another gray-haired locomotive engineer the remembrance of the old engines he used to run, and of similar experiences in his past life, and if in such a retrospect he has found a pleasure, then I am not sorry that I happened to see the little picture of the "Old Cuyahoga engine, built at Cleveland, O.," and not sorry to have said what I could in grateful remembrance of my Alma Mater.

"The Muley Cow" Smoke Burner.

There is a queer looking engine switching around the Missouri Valley, Iowa, yards of the Freemont, Elkhorn & Missouri Valley road. She is known among the men as "The Muley Cow." She is one of the many attempts to return the smoke and cinders to the ash pan, through the grates and into the fire again.

A recent issue of the Sioux City *Journal* has rather an amusing account of her performance on the road which we reproduce here.

"A well-known freight conductor came into a popular barber shop yesterday morning and threw himself into the chair.

"I've known conductors who could make a night run for six months and never lay off a day," said he, "but I've been on one for a week now, and I'm dead—plumb dead."

"Do you know," asked the barber, as he paused with the lather brush in the air, "what it costs to shave a corpse?"

"Go on with your whitewashing," returned the conductor, "and I'll change the subject. Say, you ought to see the new-fangled engine the company has been trying at Missouri Valley this week. It is one of those things supposed to consume all the smoke, cinders and soot, and have nothing but a little white fog coming out of the stack. It looks like a muley cow. The smokestack tips back, and there are two big six-inch pipes, one on each side, running back to the firebox. These are supposed to carry the smoke and cinders back to be burnt.

"Well, on the day of the trial they had the superintendent of construction on the cow-catcher, the superintendent of motive power up on top, and the general superintendent in the cab. At first Powers, the engineer, let her out easy, and she worked all right. The general superintendent is a railroad man, and he says to Powers, 'Let her slip a little.' So Powers throws her wide open and lets her slip a couple of revolutions, and the old girl coughed out about eight bushels of cinders, almost burning the overcoat off the superintendent of motive power. Of course, anybody can see that when she is thrown wide open it makes a double draught and throws the cinders the other way.

"Wise guys, these railroad officials. They cut down the men in the shops and on the sections, and spend from $3,000 to $6,000 to fix up an old engine to burn its own smoke. We've got three hands on each section now—the section boss, his wife and dog, and the dog is pretty near starved to death.

"If they want to stop the smoke nuisance, why don't they burn coal? They go down here on the Wabash and buy this mud at $3 a 100 carloads, and try to burn that. No wonder they have smoke and cinders."

"By this time the railroad man had been shaved, and as the door closed behind him he could still be heard chuckling over the operations of the muley cow smoke consumer."

We understood that the conductor who thus relieved himself was surprised by a call to "come up higher"—on the green carpet in the office—but our informant has not stated whether he was discharged or promoted.

Don't forget those prize designs. $350 cash for an idea.

Practical Letters from Practical Men.

Facts Wanted. There's a glut of Opinions.

Write on one side of the paper, state your point plainly and briefly, and then quit. We supply the generalities. No letters noticed unless name and address accompany.

Locating Trouble in a Defective Brake.

Editors:

An engineer reported that his tender-brake would not release and wanted the triple-valve examined. A plain triple-valve is the part of the brake mechanism least liable to derangement. The brake-valve was of the latest Westinghouse design, plate D 5, and I had an idea that it was faulty instead of the triple-valve. I pumped up a little air, placed the brake-valve handle at service stop, and the regular preliminary exhaust occurred, but it was continuous, and the valve-reservoir would not empty its air. Neither would the brake apply. Pump still working, I turned the handle to emergency stop and the engine and tender brakes applied, but the exhaust was from both the train-pipe and main reservoir, the pump working with increased speed to supply the waste of air. Moved the handle back to full release, and there was no blow from the small warning port.

After pressure began to accumulate, the brakes released, the tender-brake last on account of short cylinder piston travel.

The engine was fired up to go out, and while I was experimenting, the engineer showed up. I explained to him that it was the defective brake-valve that caused his brake to stick, and advised him to not use his brake that trip except in case of an emergency. He said he knew there was something wrong with his brake-valve; it had been working bad for about two weeks.

After the engine had gone I studied this puzzle, but came to no conclusion until I took down my book containing cross-section engravings of the valve, and then I located the trouble, and when the engine returned I found that I was correct. The lower gasket, 61, in brake-valve was completely worn out and in shreds, except at its outer rim under the seat casting, thus giving communication between chamber *D*, main reservoir and train-pipe. The small warning-port was closed with dirt.

There are many expert air-brake men who have a supreme contempt for illustrations. There is no part of the brake apparatus which they have not dissected, and they understand it thoroughly. They won't look in a book. Books are for apprentices—not for masters. I know something about the air-brake, and when I find the symptoms of the disease, the easiest way to locate the trouble is to look in the book, and the whole thing is right there without the confusion of separating the parts. And to quote Synnestvedt: "Use your reason first, your hands afterward, and never take anything to pieces without having some reason for doing it."

WILL W WOOD.

Terre Haute, Ind.

Another Safety Angle-Cock—Not Patented.

Editors:

"The air-brakes failed to work," is getting to be a too common excuse in railroad accidents. The air-brakes will work, unless handicapped by the cussedness or carelessness of some man. And great stress is laid to the angle-cock getting or being shut off so the engineer cannot handle the train. Now if the trouble is in the angle-cocks, we propose to stop it. Take the plug *A*, Figs. 1 and 2, and drill from the bottom up, two ⅛-inch holes, *B* and *C*, as shown in Figs. 1 and 2, and far enough up to intersect two other holes, *D* and *E*, Figs. 1 and 2. The holes *D* and *E* must be drilled so as to open a communication with the train-pipe (both ways), when the plug is turned in the position shown in Fig. 2. This will allow air to escape through these holes down and out through the small stop-cock *F* (screwed into bottom of cap *G*) and set the brakes. The stop-cock *G* is supposed to be open on all the coaches except the last one.

Now, in this condition of things, we would lose all the air; but this must not be. We want a reserve, and to do this I put on the bottom of the plug *A* the two flat springs, *H H*, Fig. 3. These springs keep a rubber valve over the holes *B* and *C*, which prevents air from escaping from the train-pipe, unless the pressure in train-pipe is in excess of what the springs will

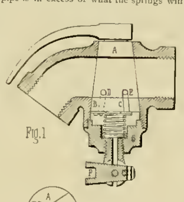


Fig.1

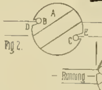


Fig 2.

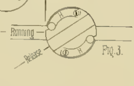


Fig.3.

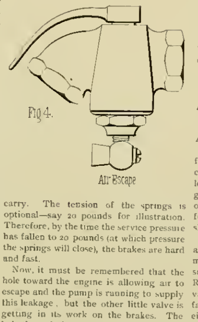


Fig 4.

Air Escape

carry. The tension of the springs is optional—say 20 pounds for illustration. Therefore, by the time the service pressure has fallen to 20 pounds (at which pressure the springs will close), the brakes are hard and fast.

Now, it must be remembered that the hole toward the engine is allowing air to escape and the pump is running to supply this leakage; but the other little valve is getting in its work on the brakes. The hole through the cock *F* should be equal to the two other holes. I have said ⅛ holes, but the size is optional. Now let us look after the angle-cock on rear coach. We shut it off and close the small stop-cock, when the train pressure will force the valve next the pipe from its seat until the cavity below the plug fills with train pressure, when the valve will close of itself. This bottom pressure also forces the outside valve (or the one next the hose) tight against its seat, so the air cannot go down one hole and out the other and escape to the atmosphere. The angle-cock on tender calls for only one valve on the plug, and that valve to be next the air-hose. As it is not advisable to cast a handle on the plug of small cock, there is a square hole cast in the plug, the train crew having keys that will fit the hole. In cutting off an engine, shut the small cock before shutting off the angle-cock; or if train is on a grade, leave the small cock open, and the brakes will set as soon as the angle-cock is shut off. Fig. 4 shows the angle-cock ready for use.

W. DI. SANNO.

Pan Handle Shop, Indianapolis.

Charging Train with Any Form of Brake-Valve.

Editors:

W. R. Scott, in his experience with the engineer's brake-valve of 1892, D 5, makes claims in favor of the old D 8 valve. I would say to release brakes under the conditions referred to, that it does not depend on the kind of brake-valve engine may have.

But it is necessary for engineman and trainmen to work together to get good results.

To couple cars with high air-pressure to cars with no air, the first thing to do is to stretch the train to see if automatic coupler is fast, and then to place engine brake-valve on lap position. The trainmen should couple hose and open angle-cock next to engine first, to test hose and coupling, and then to open into empty train, and open both angle-cocks slow, to get a service application of the brakes on high-pressure cars. The engineman should note when train line pointer becomes about stationary, to show that train line is tight and angle-cock on rear end is closed. You can then throw main reservoir pressure into train-pipe, and release one or twenty-five brakes if necessary. If you have a leaky train and have trouble getting air from the pump referred to, it is good practice to have every pound in sight put into train-pipe and auxiliary reservoirs—that is where you want it to stop trains. Don't take chances with low air-pressure.

A very important advantage when using the new D 5 valve I have not seen brought up yet. That is, when running trains down heavy mountain grades, the engineman can recharge in full release position and put main reservoir pressure of 90 pounds into auxiliary reservoirs, which is better than 70 pounds for such service. The warning port will not waste air while doing so.

J. R. ALEXANDER.

Pittsburgh, Pa.

A Kick from the Smithy—Better Shops Wanted.

Editors:

Why is it that mechanical papers will furnish us with cuts of interior of machine shop, roundhouse, wood shop, and leave out blacksmith shop? Have they not got subscribers enough among blacksmiths, or would it be a detriment to the paper to furnish cuts of the average blacksmith shop?

Are the majority of master mechanics and superintendents of railroad shops and manufacturers ashamed of their own designs? If they are not, they ought to be. Railroad shops are a little further advanced than the majority of our manufactories. But there is little sympathy in either place for the blacksmith—anything is good enough for him.

Here is a picture of the average blacksmith shop. A building with a flat roof of sheet iron or gravel, from 10 to 15 feet above the floor, with a single wall of common matched boards, 5 feet 6 inches from floor to bottom of window; steam pipes, if any, next to the sheet-iron or gravel roof; for ventilation, skylights that cannot be raised; building located between machine shop, wood shop and foundry; steam for heating, from exhaust of steam hammer; place for old iron and coal, outdoors; for a clothes closet, a spike in the wall. In the month of July the thermometer will register from 100 to 115 in this building, and in January zero. For drinking water, the hydrant, and then we are told to be temperate men and take more interest in literature on our profession.

Now it would not do for a blacksmith to design or dictate the designing of a blacksmith shop; he has not studied chemistry, electricity or steam.

I know of a shop designed by a mechanical engineer who never worked in a blacksmith shop any more than a few hours now and then for instruction—but of course there are not any points in blacksmithing that he don't know—and if he designed another one he would have the space between floor and bottom of window 6 feet 6 inches. Physicians tell us to keep feet warm and head cool; but the way this shop is designed the designer must believe in keeping head warm and feet cool. I don't believe he has brain enough to keep his head warm without some heating apparatus.

Madison, Wis. W. G. LOTTES.

If Education is Needed, What Kind?

Editors:

I wish to make a few remarks suggested by Mr. W. R. Scott's article in November number. I will not discuss the mechanical aspect of the new valve, as it seems evident to me that a man can do anything with the new valve that he can with the old, and just as easily.

If I am not mistaken, Mr. Scott is traveling engineer on A., T. & S. F. R. R., and has been for some two or three years. The A., T. & S. F. was one of the first roads in the country to put air on its freight equipment, and for nine years past has handled nearly every train with air-brakes. With the exception of one or two short intervals, if I can believe men who claim to have worked there, the company has employed one or more air-brake inspectors or traveling engineers. The Westinghouse Brake Co. has also, probably, had some representatives on the road at times, and has probably endeavored to place their instruction book in the hands of every engineer and fireman on this road as on others.

Now, I would like to ask Mr. Scott if there are not in his jurisdiction a large number of freight men, and even some passenger engineers, who never, on any train, attempt to use the excess pressure; if he does not consider the process that has been going on on A., T. & S. F. for the past nine years a "campaign of education," and if not, what kind of one he would suggest. Does he not believe that a man who has been subjected to as long an educational process as the A., T. & S. F. men have, and still fails to use the brake-valve to the best advantage, is so built mentally as to be impervious to education?

Sayre, Pa. J. CRABTREE JENKINS.

About Leaky Train Pipes—Why Engineers' Valves Cannot Always be Carried in Running Position.

Editors:

In your December edition a Mr. J. D. Murphy tells us he thinks the only thing wrong in most cases with the equalizing discharge valve is a lack of confidence on the part of the engineer, and says: "I find that when valve is in proper condition, 20 pounds excess pressure can be maintained, no matter how leaky your train-pipe. For example, have met with train, that, owing to leaks in train-pipe, pump would not supply more than 40 pounds train-pipe pressure; with this train, and equalizing discharge-valve in proper condition, have maintained 60 pounds reservoir pressure."

It is just possible that the train upon which Mr. Murphy made this interesting discovery was *standing* while this collection of data was going on; if so, very good, but if not, does Mr. Murphy mean to tell the INTELLIGENT class of engineers in this country that a train—no matter how many cars—equipped with Westinghouse automatic air-brakes, with such prominent leaks in train-pipe that an ordinary first-class pump failed to accumulate over 40 pounds of pressure, will not "*drag*" (I use "drag" advisedly—"stop" I should say under the circumstances) while handle is in running position, trying to gain the 20 pounds excess, *granting the valve is in perfect condition?* If he does, very few practical men will agree with him, I'm afraid.

If a "lack of confidence" was all that prevented the successful operation of this feature of the valve, it appears to me that railroad companies (through their traveling engineers) would have a standing "rule," or "bulletin," suspending engineers found carrying their valve handle in any other than running position while running, instead of equipping their new engines with Westinghouse's new valve, which is designed principally to make this feature a success.

As I noticed in the November edition, Mr. W. R. Scott's "campaign of education" no doubt would be a benefit all around, but in this particular feature mentioned above I fail to see where an intelligent engineer could do any more than an ignorant one while running—unless he stopped and calked up a few leaks.

G. A. ELLIS.

San Antonio, Tex.

Case of Imagination.

Editors:

Some time ago one of our engineers, whom we will call Brown, was running an engine on passenger service that was about used up for that work. She was put in freight service and another one of the same build just out of the shop given him in her place. She did not steam quite good enough to suit him, and he asked the stack man that does that work to raise her petticoat pipe ¼ inch. This man did not know of the change of engines, and raised the pipe on the old engine. Brown made a trip, and on his return reported her as steaming fine, and raising the pipe just done the business, although it had not been touched. Fact!

W. J. STUART.

North Platte, Neb.

Pipkin's Brake Questions.

Editors:

As to our friend Pipkin's questions, he, in the first instance, probably has had a plate D 8 brake-valve in which the feed-valve No. 21 allows the main reservoir pressure to flow back into train-pipe. In that case grind valve. In the second one, description is not complete enough to locate; should think pump would lag or crawl from 60 to 70 pounds, and in that case would look for some obstruction in governor or small pipe leading from it to train-pipe. While the quick action might possibly be brought into action on the rear cars spoken of by leaving the train-pipe open, it would not be reliable, and would probably refuse to work if only a reduction was made sufficient to start the quick action on the five cars in front.

Roanoke, Va. GEORGE HOLMES.

Electric Wires vs. Line Shafting.

Editors:

Many of our readers will remember the several articles I have written which called attention to some foolish, or worse, statements made by the too ardent advocates of this method of transmission, but its good points are not to be overlooked, and it seems to have a special adaptation to the supplanting of line shafts in a great deal of shop work. It is safe to say that not one man in a hundred realizes the amount of power consumed in running the long lines of shafting which are so common as to attract no attention, and probably not one in this same number would believe that at many times fully fifty per cent. of the power of the engine is used before it begins to do useful work at the machines, and the percentage often runs way above this. Suppose the shop is designed to supply 500 horse-power, and the shafting is calculated accordingly, the long lines of shafting, or numerous intermediate shafts, with the attendant losses by belting, will consume a great amount of power whether a machine is doing work or not; in other words, the dead load on the engine is constant, and in a large shop is often fifty per cent. or more of the total power developed by the engine. When, as it often happens, particularly in railroad shops, we wish to run a portion of the plant only, for a night job perhaps, we must either run the entire shafting (as well as all counter shafting which is connected to it, unless the many belts are thrown off beforehand), or if the portion wanted happens to be next to the engine we can uncouple some shaft coupling and proceed.

But when this happens to a portion of the shop farthest from the engine, there is no other way than to run the whole shafting, and it is very probable that the shafting consumes ten times the power that the useful work does, making it very expensive to run a portion of the shop, although this expense hardly ever seems to be taken into account. Now, it becomes necessary to enlarge the shop, and additions are made which necessitate 100 more horse-power at the further end of the shop, and nothing can be done except change the whole shafting, as the former sizes are too small to transmit the additional 100 horse-power, or else the shafting was larger than necessary in the first place, and has been consuming more power than necessary all the time.

So we must either enlarge our line shafting or else install an engine at the other end for the additional power, making two separate engine-rooms with the attendant evils of long steam piping and condensation, or the establishment of a new fire-room. Or, perhaps the engine may be moved to a more central location in the line shafting, and the power divided up in this way.

The running of long lines of shafting is a nice job and requires experience and care, and the alignment is affected by the belting and other causes, and should be attended to by a competent man in order to reduce the waste as much as possible. Even this is not done in too many shops, and shafts that are kept in line are the exception rather than the rule.

Within the past year, or perhaps a little longer, there have been several plants installed in which the regulation line shafts, which for so long have been a fixture in every shop, were quietly dropped, and in their stead insulated wires are run along the ceiling on porcelain supports, and small electric motors are placed either on the machine itself or to drive a small countershaft from which power is taken for a group of machinery. The power can be led off at any point desired, and any portion of the entire shop can run quite independent of any other portion, and best of all, consuming only the actual power required to drive that section, plus the engine friction and the loss in the dynamo and motor, both of which need not exceed 15 per cent. to 20 per cent. of power being used.

By being generous in the amount of copper used in the line wires you can add considerable power without changing the wire, the larger section of copper making the loss in transmission less, while the allowance in extra-sized shafting is consuming more power all the time. Or the additions can readily be made by running new lines beside the old for the additional power, the cost or labor of erecting is much less than in the case of shafting, with very much less in the operating expenses. It has been demonstrated in several instances that even with ordinary running the electrical transmission is slightly cheaper than the old method of line shafting, despite the fact that the application of numerous small motors must be less economical than a large motor of the same capacity, but the difference is more than made by the saving in shafting friction. Besides this, we have the independence of different departments, and there is no delaying the whole shop by any accident to a belt in one department.

Experiments have shown that with a plant of 1,000 horse power capacity the efficiency at full load with electric motors in the subdivided power form was 79.4 per cent., and that of shafting in first-class condition about the same. With one half load the electrical efficiency has only dropped to 74.7 per cent., while the shafting has dropped to 58.8 per cent., and at quarter load the electricity has 57 per cent. against 17.6 per cent. of the shafting, and as the actual load in shops rarely exceeds one-half the total capacity that must be provided for, the comparative working efficiency can readily be seen.

Taking the case of a railroad shop, where it is often necessary to run the wheel lathe at night, it would be infinitely cheaper to run wires to the wheel lathe, put a motor direct on the lathe for use at night only, and run from the regular lighting dynamo, or else have one installed for power purposes.

While it would generally be cheaper to run from this motor all the time, it would be advantageous, if only used at times when the rest of the shop need not run, and there are other machines or groups of machines which could be similarly equipped to advantage. The electric dynamo and motor have passed the experimental stage, and their capacities are now as well known as any other machine we have, and their liability to failure is not greater than many other machines.

They are much better than small steam engines, for it is far better to carry wires to different points than to carry steam-pipes the same distance, and there is no exhaust steam to get rid of after it has been used, and the small space for the power developed as well as the little attention required makes it better in many ways.

As hardly any shop of consequence thinks of operating their traveling cranes by any other power than electricity (or more properly any other means of transmission) so it will probably be in a few years that the power in shops will be subdivided by this same means, making a much more flexible arrangement than the shafting of the present. For portable drilling or similar work it compares very favorably with compressed air, and is better than steam on account of the freedom from exhaust, and its ease of connection where wires are run for other power purposes makes it very useful. In this way much work that is done by hand can be power driven, and much hard work and unnecessary expense saved.

It would be useless to claim that this arrangement would be perfect, but it seems to possess more points of merit than any other to date, and with the precedents that have been set there should not be very much hesitation in adopting it wherever it seems advisable, as any reputable firm will undertake the contract and guarantee efficiencies, which is more than many millwrights are ready to do for shafting.

FRED. H. COLVIN.

Philadelphia, Pa.

Does the Machine Pay?

Editors:

Your January number contains an article on rolling flues by power, which is not all explained and might have been overlooked by the writer. He does not tell the good or bad of this process, or how long it requires to roll a set. He also fails to say that it requires two men to run the machine. I have seen this same machine tried in several places, and it took from two and a half to three hours to place it in position, and from one to two hours to take it down, and five to six hours to roll a set, two men occupied all the time where one man can roll the largest set by hand in eight to ten hours; thus, in my opinion, there is nothing made by this process. I would like to hear more on this subject from different parties.

Des Moines, Iowa. J. K. EVANS.

[So far as we can see the machine requires only two bolts to set it. Any boiler-maker who was more than an hour getting ready to use it, after front was off and steam pipes removed, would be a bigger loafer than a navy yard apprentice.]

Machine for Tapping Holes in Smoke-boxes.

Editors.

It is often desired to tap holes in the smokebox, when these are in the flue sheet it often becomes a hard matter to get them tapped straight on account of the double plate so commonly used. The job is not only liable to be out of true, but it is slow work and disagreeable.

Perhaps a little experience in this line may be of use to other men in the same line. I make flexible shafting do all such work that I can, and this is easily done.

I have some taps here that have a shank about 2¼ inches long, and they are all one size of square. I had a socket put on one

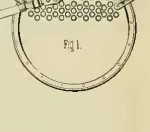


Fig 1.

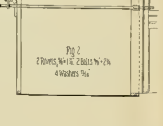
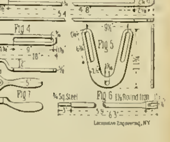


Fig 2
2 Rivets, ⅜×1¼. 2 Bolts ⅜×2¾.
4 Washers ⁹⁄₁₆.



end of a 1¼-inch rod of iron, with a hole in it to fit these taps and a square shank of steel put on the end, Fig. 6, to fit the square in the compound box.

I then had the slide, Fig. 3, made, and riveted the clamps, Fig. 4, to this to put it in shape to attach to the smoke-arch ring, to allow the guide, Fig. 5, to slide upon it and be adjusted through medium of the slots to a perfect alignment with the hole to be tapped. Fig. 7 is a handle-nut, two of which are required. This saves looking for a wrench when adjusting the guide, as the time between setting is very short, it taking a very short time to run the tap through a hole.

Dubuque, Iowa. C. E. FURNESS.

Danger in Applying Brakes From Rear of Train While Backing Out of Stations.

Editors :

There has been a number of criticisms lately in some of the railroad journals on who should handle the brakes on a passenger train, in making service stops, while backing up. In one particular there is, I believe, great danger on account of the widespread habit of placing control of the brakes in the hands of the man at rear of train, when backing from yard to depot. That many accidents are due to this practice is certain, and that these lessons are often lost sight of will be apparent from the following:

On a yard being established at a well-known city, the capital of one of our most progressive States, I was sent to look up the air-brake part. I was warned before arriving that everybody was old hands from roads that might be said to have established systems, and that the methods employed by them were approved practicably by all the air-brake experts who had anything to do with them.

The brakes on the train I came in on did not seem to bear this out, but on coming into the depot my attention was attracted by a man who made up the passenger trains for the road. He was a hustler, and one of his duties was to act as a yard conductor, taking the trains some two miles to and from the depot to the yard. While riding up to the yard he told some very entertaining stories of how he backed trains into one of the largest depots in the country for years, and never had but one accident, when the brakes, after working well till they reached the depot, refused to take hold and he came near being killed in the smash-up; and at the investigation he could learn nothing of what the matter might be, but was told that he did right in opening the backing whistle to set the brakes.

He had one of this kind of hose with him, with a pipe and stop-cock, but had not yet procured a whistle, but he would show me how he could handle a train just as well as the engineer when we came down again; but he wanted to know what made the brakes fail at the time of his accident. Telling him I would think it over, I got on the engine of the next train backing down, the hostler who took the engine looked very much disgusted with his job, but on getting the signal began backing with the brake-valve handle in release position. About every ten or fifteen rods the man at rear end would see a wagon near a crossing or have some reason for slacking up the train by letting air out of train-pipe with his whistle-hose, when the hostler would yell, "cussit," and the temporary conductor invariably answered. By the time the depot was in sight there was a swearing match between the front and rear representatives of the train, and only 30 pounds of air in the main reservoir. I found this was a regular thing, and on returning to the yard assembled the hostler, the air-inspector, who wanted the brakes tried as soon as they were coupled up, the yard conductor, and as many more as could be obtained, and having with me a brake and triple-valve cut in sections, I put a gauge on a car brake cylinder and one on the auxiliary reservoir, which the inspector and conductor timed while charging to 70 pounds. I then went to rear of train with his backing hose and applied the brakes till the men got an idea of the action of them; then, having a man on the engine to work the brakes, I put the sectional valves in the position assumed by the valves in operation, pointing out the feed groove, graduating port, proportion of auxiliary pressure to brake cylinder at 5, 10, 15, 20 pounds and emergency applications, and the time it required to recharge after each application, and showed by the gauge how much air was lost by not giving time to recharge; then, with the entire party on the engine, the hostler used the brakes and attention was called to the fact that the red hand registering main reservoir pressure gained while brakes were on and that this pressure was the same to the train-pipe as the boiler was to the steam chests.

Getting this plain, a man was sent to the rear of train to work the backing-hose as a service stop brake. After watching the air gauge a while, the yard conductor, who is more intelligent than the general run, broke out with: "Then, whenever I set the brakes from the rear end, I steal all the air from the big drum unless that handle is on lap." Being told this was a fact, he said "Well, I'll never use it again only to whistle with or for an emergency." After the others had left, he came to me and said, "Then that was what smashed that train in the depot that I was telling you about. You bet I don't ever tell any one else what I done there." I told him he could not be blamed for what he had not been learned.

I made some inquiries, and learn that it is not an uncommon occurrence to have the brakes fail to set while backing in this manner, and in a great many cases the reasons for such failures are kept in the background. If the men who are so enthusiastic in trying to beat the engineer in handling his brakes would only investigate before they practice, they would soon find that the engineer's brake-valve is open to main reservoir in either release or running position, and when he applies the brake, it *cuts out the main reservoir from the train-pipe* and saves the air in it, while in case the brake is applied elsewhere, the main reservoir is robbed of its pressure, as well as the train-pipe, and a very few applications in a limited time would so reduce the braking power that it would be practically useless. GEO. HOLMES.

Roanoke, Va.

A Hard Blow to Locate.

Editors :

Mr. C. E. Conger in November issue gives a batch of kinks that for the time "had the boys in the corner," but was easy enough when found out. It brings to mind a little "drama" that occurred on one of our Southern roads a few years since, and the extent to which an interested party may be befuddled can be imagined from the condensed history of the case in question.

Sam B—— was a quick mettled, positive, nervous kind of an old blunderbuss, who had been in the service a long while, and withal was a successful runner, but had, through force of habit and continual practice and perseverance, in an apparently fixed line of grievances, fell heir to the sobriquet of "Old Set-up Wedges."

A new train was to go on a little seventy-mile run, and a 15-in. engine, then in shop for general overhauling, was given to Sam for the "Jerkwater" when she came out. For a few trips old Sam's rubicund, and not overly handsome face, was as radiant with smiles as a young bride's; but he came in one A. M. minus the smiles and reported

"Engine Blose sometimes wuss than Others, set up Wedges. No stock but Allso look round." As he usually came down to roundhouse about 10 A. M., the foreman waited to get at the case a little more definitely from Sam by word of mouth, and on inquiry, he said: "She blows like hell'n blazes sometimes, and then agin she's all right." He "thought a packing-ring had busted and fell down, and then again would get back in its place."

The pistons were examined and found O. K. Lids lifted and valves all right (old S. U. W. staying to see it well done), and when told by foreman "the blow was in cab on his side," the boys began to smile; old Sam got *real* red in the face and went home. Next trip report amounted to same thing, after which some one added "Oh, rats!"

The gang being a little larger that day, had read it, and were on the *qui vive* for old Sam, who at the usual time put in and began by saying

"Boys, for twenty-three year I've been ridin' on the right hand side and "— Here Ed. D—— brought the book and asked why he didn't sign his name. He did so and read the report over—" * * * and set up wedges. Oh, rats!"

"Oh——! Now, gentlemen, I can just lick the dewd that writ them 'Rats,' or any other man who says that engine don't blow."

The M. M. passing through just then, he bolted, and from the gestures he made him it was inferred his explanation was a forcible one.

The front was opened, pipes examined, and nozzles scraped out. When Sam went out on next trip road foreman went with him, 30 miles to meeting point; the blow failing to show up he turned back and Sam went on his way rejoicing, but next day when he came in the circus opened, old Sam seemed dazed, and with a bewildered look, cussed everything in sight in a plaintive tone that suggested he had sustained a sad loss or a heavy blow, and under the numerous casualties, remedies, and guys that were made him, he was influenced to believe his hearing was failing, and though he hooted the idea, on his way home consulted a physician, and confidentially told his fireman on next out trip, "that he had left his tobacco behind, and didn't intend to drink any more coffee. That since the first day he took her,—when the boss ordered him to take his horseshoes off the head-light brackets—he'd a hankering that something would happen, and d——d if it hadn't, or at least part of it, and he hoped to live long enough to see what would the harvest be."

Well, next morning, old "S. U. W." came in about two hours late, and rode in the roundhouse with hostler, many anxious faces were watching old Sam, but he heeded them not, the sunny smile had flown, and a far-away look rested on his countenance. At last seeming to suddenly remember where he was, he washed up, put his towel in the grip, overalls under his arm, left his hat and made for the M. M. bareheaded, whose complacent smile intensified the wild look in Sam's eyes, to the extent that after saying, "That blow," he stopped short and was the picture of inquiry, suspicion and disgust so long, that when asked, "Well, what of it?" continued, "Mr. —— I want to get off a few days; something's wrong with me, or that old pelter of a '212.' I ain't fit to go out (holding up a bandaged finger—poor excuse better than none) let some of these smarty valve-setters try her."

Well, a "valve-setter" did try her, and found the trouble. I was at first disposed to let the boys guess at this awhile, but as that takes so long I'll give it away.

The new runner found her all right until he tried to make a run for a bill, when the peculiar blow commenced and increased, the engine acting lame and making a strange noise, but just as soon as steam was shut off it stopped, and did not commence again when throttle was opened out on the level. When he got in the valve-setter had the nozzle stand taken off and the passages "fished." They found a washer for an inch bolt in one of them, this was $2\frac{1}{4}$ inches outside, with an inch hole in it, and had been left in the passages by some one in the shop. When worked very hard it would come up and choke one of the nozzles.

Waycross, Ga. A. A. BROWN.

Will This Tell How Many Brakes are Coupled Up?

Editors :

Having noticed several articles in your paper on tramps and angle-cocks, perhaps this idea of mine supplanting cocks and tramps will be permissible.

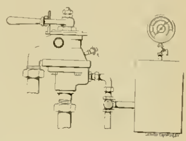
Now, to remedy this troublesome cock, means probably, the changing of all angle-cocks in use. Now, why not do it another way.

Every engineer knows that the longer his train, the longer his equalizing-valve blows. It is this very principle, and very valve I propose using.

Tap a ¼-inch hole in brake-valve as shown in sketch, then place nipple and ¼-inch cock so that they will communicate with the brake-valve reservoir; also in the exhaust-pipe of the brake-valve place a three-way cock.

The side outlet of three-way cock connects with a small drum, and on drum there is a gauge, properly connected and marked off, that is, marked cars instead of pounds.

Now, if the engineer wishes to ascertain if his train is all cut in, puts his brake-valve on lap, closes three-way cock *B* and



opens and closes cock *A*, about as quick as convenient. This will cause a small blow of the equalizing valve; not enough to set the brakes, of course.

The pressure that escapes from the train-pipe into the small drum records on gauge the number of cars cut in on the train.

After ascertaining this fact, the engineer puts valve on running position, and moves three-way cock to its original position.

This device is very simple, and from tests I have made I have found out that it will work all right and be quite reliable.

I would be pleased to know what your correspondents think of this simple idea.

Chicago, Ill. GEO. HAZEN.

Early Blowers.

Editors :

Forty-eight years ago the P. & Reading R. R. had a class of Baldwin engines with drop hooks, rock shaft under the furnace door, with sockets for starting-bars which stood convenient. When an engine failed for steam through leaky flues, bad wood, etc., the engineer threw his engine out of gear, put a starting-bar in a socket in the rock shaft, and moved the valve until it uncovered the exhaust-port a little, gave the engine steam, and a blower was the result. Was this the original blower?

Newton, Kan. JOHN BOURNE.

[This was the usual way of "blowing up" before the advent of the independent blower.]

Had a "Choker" on It.

Editors :

One of our engines went out of the shop recently with general repairs, and after trial trip was sent to one of the branches. After a few days a request came for another pump, as the one on her would not supply the train. Another pump was sent, but with no better results. Either one of the pumps would pump pressure enough, leaving out the element of time, but when "wind" was wanted in any quantity, there was a dead failure to get there. So fast and no faster. Having struck its gait, oil, copper hammer, all the persuasions and blandishments of man would not make that pump make another stroke faster. The train was one easily supplied by a 6-inch pump, so the fault did not lie there. After much trouble the difficulty was located.

The blower-pipe in front end had been put on the right side, and the closed end of the pipe would not let the steam get away from the pump fast enough.

Boone, Ia. F. W. PETERSON.

Around the World, to China, and Home.

Notes Taken by E. J. Lewis, an American Engineer Who Went to China with the First Air-Brakes.

Thinking that the readers of LOCOMOTIVE ENGINEERING would be interested in what I saw and felt and done in the service of the Imperial Railways of China, I send you herewith a photograph of one of the engines there, the first to get an air-brake, and some notes of my trip around the world.

This picture was taken near the wall of the city leading out of Tientsin, China, just south of the station. The engineer (called a driver there) is Mr. J. Buchanan. The two firemen on front end are natives, we call them Mosy and Muldoon. The three standing at the side on the ground are Mr. W. S. Hamilton, next to the engine, the one in the middle myself, and the other Mr. Thomas Preston, an Englishman, track inspector. The house fronting the road, surrounded by a wall, is where we lived while in China, which was from August 17, 1892, till next March, 1893

In the spring of '92 Mr. R M Brown was sent to America as an agent of the Imperial Chinese Railways to contract and arrange for a sufficient number of the W. A B apparatus for trial.

Two complete equipments, one for an 8-wheel engine and for a 10-wheel engine, ten sets for passenger and twenty sets for freight cars, was considered sufficient.

Mr. E. W Newell, a designing draughtsman of the W. A. B. Co., and two engineers of the C. & P. Division Penn'a Co. were engaged to go with the air-brake machinery to China and put it into use on the China railway. We got ready and started for Vancouver, B. C., July 5th, had a pleasant trip to the coast by the Northern Pacific Railway, stopping on the way several times, arriving at Vancouver July 17th, in time to take the Canadian steamship *Empress of China*, one of the three largest boats on the Pacific. Vancouver is a growing and interesting place, as it is the terminal of the Canadian Pacific Railway, but our stay was not as agreeable as it might be on account of the small-pox. On the 18th all was ready to let loose and sail away to the far East. Apparently nearly all the town came down to see the *Empress* leave.

It is an impressive sight, standing on deck watching the parting of friends, some never to return, and a possibility of none ever reaching the other side. But to look over a ship like this and see the precautions, and men of large experience in command, one does not have much fear of not reaching *terra firma* again. At 9 P. M. the *Empress* silently drifted out into the Puget Sound, and soon the pulsation of her 10,000 horse-power machinery was felt moving her quietly down the Sound toward the Pacific. We went to bed as contentedly as though we were at home, and awakened the next morning just striking the ocean. There was an unusually strong wind for that part of the trip, causing her to rise and fall in an uncomfortable manner. Soon after rising I was called for breakfast, went up just because it is customary to eat at that time. Shortly after and for several days did not think much of ocean life. Eating up all the pies and cakes and smoking cigars while your parents are at church the first time is nothing. As I had to stand it for a few days I got better, but never entirely clear of it the whole trip. Would say to any one thinking they cannot live without her, just make a sea voyage, it will probably save his life.

The Empress line of boats keep up in rather high latitude, just miss the Aleutian Islands; it is uncomfortably cold for July, could not keep warm outside of being in bed, except going down below where the engines are. It was such a contrast, as it was very warm when we left home. About this time whales were seen occasionally and small birds from the islands. At times it was very foggy and would be very dangerous should there be any boats on the line or obstruction to the *Empress* rushing through the darkness, with her voice of death, given by the fog horn, to keep out of the way. It is remarkable how those birds, the albatross, can follow boats for days. It is no wonder sailors have such superstitious ideas, as they are with such surroundings the most of the time and their associates limited to a few like themselves, and only hearing the news of the day while in port.

Soon only such questions and things pertaining to the people, as a nation, of their welfare that they become interested in.

I was surprised how soon a person will, when surrounded by strange customs and people, soon forget their native land and be so taken up with things around them. Their former home would not be thought of much, only when hearing from friends by mail.

The trip around the world from California coast to China is where a day is lost. But few people understand this, nearly all that make the trip over do, upon a little reflection, as this is generally talked of about the time the line is crossed.

A strong current passes up past the Japanese coast and over towards Washington. The water is warm, which must be one reason why they have such nice weather in winter at that high latitude. A perceptible increase is necessary in the speed of the engines to make the time.

On July 30 we were going nearly south and sighted the mountains of northern Japan. That evening we had a beautiful sunset, said to be equal to any in the world.

All the next day was in sight of land the most of the time; everywhere could be seen small Japanese fishing boats. There must be many of the people lost at times when a storm springs up, which happens frequently. This is on the line of terrible typhoons that start down in the China Sea and sweep toward the north. These typhoons are storms similar to cyclones we have on land. A ship having lots of sea room, say fifty miles each way, and nothing happens to her power of controlling herself, will likely come out all right. Last fall the steamer *Bokara* became unmanageable by the water putting the fires out, allowing her to be carried over toward the Pescadore Islands, near Formosa, on the rocks, going down with nearly all on board being lost.

It was quite a pleasure to see land and the prospect of getting on it once more, even if it was a foreign one. We entered the Inland Sea, a narrow, rocky passage of water that divides Japan into two parts; Yokohama is situated about ten miles inland from the coast. It is just like going up a large river through this channel to the city. In all directions are seen small boats usually propelled by sculling at the sides and rear end.

This class of Japanese are a very dark color, and wear but little clothing; not an uncommon thing to see them with hardly anything on them but a large hat.

The weather was very warm at that time. We dressed in light clothing, wore sun hats, carried umbrellas and rode as much as possible, and were uncomfortably warm.

The *Empress* anchored in the harbor at 4 P. M. July 31st, surrounded by numerous small craft, with nearly naked coolies, all looking for some one to take ashore

Some of the hotels have small steam tugs for landing the passengers going to their hotel. The Grand, at Yokohama, is the finest place in all the East, and is appropriately named. In those countries the street facing the water is called the Bund. Yokohama is the principal port of Japan, and the place where warships of several countries spend the months pleasantly, as the natives are favorable to foreigners, and treat any one well that does well with them. Every one must pass through the Custom House about the same as at New York.

All the Custom House men can talk some English, but not well enough to enter into an argument with them if you think anything you have should not be retained for duty. I was somewhat angry when they refused to allow my type-writer to go through free, but when I thought of home, how we meet them when they come there, it made some difference. They are death on Kodaks; all must pay so much duty on them, as they have good photographers among their own people that want to take views of things in Japan.

You are besieged on all sides by professional guides; any one wishing to save time should employ one. The first thing you will notice the most first is the jinrikisha, a miniature buggy having two wheels, and top to put up when it rains, having shafts arranged for a coolie to pull it like a horse. At first a person is opposed to getting in one, but you see all the others do so, you feel like you should do the same. Once is enough; everywhere you want to ride that way. To any one not knowing the city must do so, as the streets are so irregular and the houses not numbered in regular order. All you have to know is the number of where you wish to go. Just say so to the jinrikisha man, he will soon take you there. It is wonderful, their power of endurance.

I remember at Tokyo we went to the station, about three miles, in a boiling hot sun in less than thirty minutes. They seemed to go faster towards the last than at first, as they were instructed we must be there in a certain time, and must make it.

The people are very cleanly about their person, which is not true of some other people in those Eastern countries. Bathing is almost a religious duty, from the attention they give to it. Many of the towns have canals running through them, and most any time they have a chance are bathing, regardless of the thousands of people passing. A person soon gets so they do not notice things they do. If it was in other countries, the authorities would put them in prison.

Many of them, with their straight black hair and shape of the nose, make a person think they are a part of our Indians or our Indians a branch of the Japs.

The fare is about 50 cents per day, if you want them that long, and 5 to 10 cents for short rides. I never met but one that did not ask for more. You soon learn what is right, and pay them and walk on.

The Japs as a people are very pleasant and courteous to foreigners. If you do not know about what you should pay for an article they want to sell, you would be surprised how much cheaper it could be bought for rather than miss selling it. The shop-keepers do not have counters as we do for showing their goods, but sit down on the floor with them, giving you a mat to do the same. Most all the large cities have a store kept by a foreigner that asks fabulous prices for things in the pottery line. A fortune could soon be spent in that way.

We visited several temples of the Japanese religion, some of them very fine and rich in ornamentation. The one used by the Mikado has many old books written in Sanscrit brought from India several hundred years ago. Considerable gold and copper is used in decorating the interior. The floor is made of lacquer-work with not a scratch on it, as all must take off their shoes before entering and put on soft slippers. The natives take advantage of the attraction of these places by establishing bazaars near the road to the temples. They have a large one that seems to be for

FIRST ENGINE WITH THE AIR-BRAKE, IMPERIAL CHINESE RAILWAY.

the public generally, as there was a constant stream of people going and coming from it.

No objection was offered to us going in and watching the performance I was particularly struck by the attention given a red, monkish idol called Bindzum, that sits calmly on the right side of the room A person who has any bodily infirmity rubs the affected part and the corresponding part of the idol alternately; the idol is believed to take the disease from the body to itself, and consequently the person is healed. It is patronized so much that its face is worn nearly smooth, and many flat places on different parts of its body. As it is made of wood, and rubbed so much, the former features are gone

We went by the Emperor's grounds, which are guarded in all directions with soldiers He has two styles of residences, one native, the other European. I am told foreign dress and customs are popular with the Japanese. The ladies are not what we would call beautiful, but are very pleasant and polite toward foreigners. I made the acquaintance of a Japanese gentleman at Kydo, that took me out calling on some of his friends.

We were met at the door by the girls with slippers. I put mine on and followed the rest into a plain-looking but very neat room could see no furniture such as we have but soon a servant came with several mats scattering them around for us to sit on I could not sit down on mine apparently as comfortable and gracefully as they did. Pitcher, ice and lemonade were brought in the fruit was passed around with chopsticks I did not have much success using mine, so just took out my knife, made one of them sharp like a fork, and used it the same as one. My failure to handle them as they did seemed to amuse them very much; I guess they had a good time. As I did not know a word they said, only what my friend told me, I am not sure I enjoyed it much. When ready to leave, my shoes were gone, just as I expected might happen, but found one of the servants had put them in a closet. Their houses seem to be all sliding doors as regards the making of rooms

When building a house the roof is put up first, the rest finished afterwards. The Japs seem to excel in woodwork more than anything they make. They are natural born imitators. Most anything they buy abroad, it is not long till they make it, they now make electric light machinery and telephones.

Foreign countries have no treaty with them yet that can prevent them from making our patented articles. Other countries cannot expect much profit from their sending anything new there, as they would soon make it. It is remarkable the work they can do in wood that requires time and patience and small pay. For instance, a man will build a Japanese miniature house, not over 8 inches square, complete, having mats on the floor made of bamboo, with the grain of the wood so arranged as to give the appearance of a mat. It will take a month's time to build and then sell it for $15 Japanese money, about $10 gold now. We do not appreciate what a convenient money system we have in this country; nearly all those countries are changing from day to day. Silver (Mexican) is the currency generally used from China to India. It fell from 71 to 65 what time we were there (six months). Many business men that invested in China years ago can not now afford to leave there and go home, as they will lose so much in the exchange. A silver dollar is worth whatever the amount of silver it contains at the market prices of silver at that time. At any port you stop and wish to get money in the native currency, the gold dollar is the basis of exchange. Mexican silver is the money mostly used in China among the better class of Chinese, but a small copper coin called a cash is used by the coolie class. It takes 1,500 of them to make a gold dollar, 1,000 for a Mexican dollar. The natives, buying in such small quantities and living necessities so small, is why such small money is necessary. China coins but very little silver, their principal business through the banks are rated in taels; there is no money coined by that name. Paper notes similar to our money are issued representing taels. A tael is nearly the same in value as a gold dollar and does not change much, usually rated about 98 cents. The Chinese are suspicious of silver money, as it is counterfeited so much. Experts are employed at the banks that soon detect one by the sound of it struck against one another They prefer a dollar that is chopped or mutilated, one we would not take would suit them, as it shows it has been tested. They hesitate about taking a bright, new one for fear it is not good.

Paper notes are issued representing the copper cash. This cash have square holes through them, so they can put them on a string of 250 each, equal to 25 cents, but I never found the full number in a bunch—usually 248.

While at Yokohama we called on the general traffic manager for permission to examine their shops at Tokyo and railway system generally. He is an Englishman, being one of the few employed by the railways of Japan. He surprised us, when ready to leave his office, by handing us transportation over the Japanese roads, at the same time saying he was pleased to do so, as the Pennsylvania Company did the same for him while in America not long ago.

The Japanese railways comprise about 1,500 miles of 3 ft. 6 in. track. They run their trains on the staff system. The track is in good condition, which can be done on account of labor being so plenty and cheap. All road crossings, bridges, and switches have men stationed at them. It appears as though they must see how many men they can employ. Considerable tunneling is done in hilly countries to avoid heavy grades. They have considerable double track. On single tracks at the station they have double track quite a distance each side of the station, with the switches set for all trains to the left. (The practice is noticeable in Japan that everything meeting always turns to the left.)

The switches are set right, and the switch-lever holding switch in position is weighted, so that when a train leaves a station they can run through it, leaving it right for the train coming in opposite direction. Usually the switchman is there holding the switch closed, but does not go near it when a train is approaching the station, as the track is right. By this plan two trains approaching a station cannot have a collision unless they should run by quite a distance. They have nice clean-looking engines, of the eight-wheel and ten-wheel class, some of them tank engines and quite a number of them having the Joy valve motion. All that we saw were from England but one, which was a Baldwin, which is said to not do any more work than the English engine, and burns about twenty-five pounds more coal per mile. I saw the coal record for several months, and I think the record stood about fifty to seventy-five pounds per mile against the Baldwin. At first she would not steam until the netting and deflector was removed from the smoke-box. When that was done had no more trouble for steam.

This is something we noticed in about all foreign engines, they don't use netting and such arrangements, but have large nozzles, and pay attention to their dampers, and I do not see as they have any trouble with sparks. As we were strangers to the condition and fuel of the Japanese engines, we could not say anything as to why the Baldwin does not do better, or haul more cars than the other ones, as she has an inch more cylinder. I heard one reason given why they thought she used so much coal, was she had so much heating surface and grate area. She really would make more steam than she could use

Foreign engines run with large nozzles on do not burn near the coal our engines do; but I doubt whether they would handle our trains as well as in this country.

The stations are nicely kept and passengers cannot cross from one side to the other only by an over-head bridge. Quite a number of coolies are kept about the place to do the work, such as loading freight and switching cars Open cars with tarpaulin for covering are used extensively. At each station is placed a large clock, so that trainmen can see the time plainly when passing. I have known drivers in China to run for weeks without a watch.

Japanese railways have separate passenger and freight trains, with passengers first, second and third class. Passenger cars are similar in style to the English, with occasionally the improvement of drinking water and water-closets in the first-class cars.

The vacuum automatic brake system is used on nearly all the cars. As their cars range from 10,000 to 20,000 lbs. in weight, this system of braking works very nicely. The cars are coupled by a screw and spring buffer arrangement; starting and stopping is smoothly done, similar to the trains run on the Elevated in New York. As trains are moved on the staff system, really only one train on the road at a time, and regular stopping places, their brake gives good satisfaction on their light cars.

It is thought when their new standard gauge railway, which will be necessary some time, as they are their cars are too small now for their cavalry. It seems their horses are getting larger It is very probable then the high-pressure brake system will be used.

While at Tokyo we visited the railway shops under the charge of Mr. McDonald, who showed us around very pleasantly. All the workmen in the shops are natives,


LOCOMOTIVE ENGINEERING N.Y.

THE "999" ON HER ARRIVAL IN NEW YORK FROM THE WORLD'S FAIR and also all the men on the railway trains are the same. Did not inquire into the wages of the men, but understood the drivers were paid about $25 gold per month. That is probably the highest paid in the service outside the officials. The time is soon at hand when but very few foreigners will be employed. While we were there some lost their heads and Japs succeeded them. Some of the Japs are excellent workmen in iron, but their best is shown working in wood. It is true they do so many things opposite to other people. Their lathes turn away from the operator, having the tool upside down, saws are filed to cut as it is drawn back, and planes the same way. All the cars are built there. Only import such things they cannot make conveniently. Car wheels all steel are used, as it is cheaper in the end to get the very best. Cast wheels, such as we use, to many soon become defective to use them.

After spending ten days around in Japan, started for Kobe by rail, which was a pleasant one through the country, showing how most of the Japs make their living—raising rice and tea. They appear like a very industrious kind of a people, but rather close about spending money for wearing apparel, investing the most in large-brim straw hats. Kobe is something like Yokohama, people of all countries assembled there. Witnessed a baseball game between the citizens and the crew of the warship *Marion*, 17 to 2, in favor of the marines. *Marion's* brass band furnished the music, making a fellow feel like he was at home seeing a game. Took passage for China on the Japanese steamer *Genkai Marie*, a line of boats the same as the Empress Line, only smaller, of 1,250 tons capacity.

(*Concluded next month.*)

The Webb Engine and Her Train.

After the World's Fair the Webb compound and two cars came from Chicago to New York over the Lake Shore and New York Central in company with the "999" and her train of Wagners. A friend of this paper "got a shot" at them as they appeared in the Grand Central Station, in this city.

It will be noticed that the "Queen-Empress" is carrying an American headlight on the front end and a bell set up on the tank, both of which were necessary while running on American railroads.

Following are a few of the principal dimensions of the engine:

Two high-pressure cylinders 15 in. in diameter by 24 in stroke, and one low-pressure cylinder 30 in. in diameter by 24 in. stroke. The engine is carried on four pairs of wheels, the leading pair being 4 ft. 1½ in. in diameter, fitted with Webb's radial axle-box with central controlling spring. Diameter of driving-wheels 7 ft. 1 in., trailing wheels 4 ft. 1½ in., axle-boxes having ½ in. side play. Driving-wheels being in front of firebox necessitates having a long boiler, barrel of which is 18 ft. 6 in. long, made of ½-in. steel plates, having a mean diameter of 4 ft. 3 in., the firebox casing being 6 ft. 10 in. long. A combustion chamber is placed in barrel of boiler, between firebox and smokebox tube-plates, so as to divide tubes into two lengths. Access is obtained to chamber by an opening at bottom, to which is attached a hopper for getting rid of ashes. To bottom of hopper is fixed a valve, which is air-tight and weighted, so that in its normal position it will be closed; it is also connected to the footplate with a rod, so that the "driver" can open it when necessary to let out the ashes. There are 156 tubes 2¼ in. diameter outside; length of tubes between firebox and combustion chamber, 5 ft. 10 in., between combustion chamber and smokebox, 10 ft. 1 in. Heating surface of tubes, 1,346 sq. ft. Combustion chamber, 39.1 sq. ft. Firebox, 120.6 sq. ft. Total heating surface, 1505.7 sq. feet. Fire-grate area, 20.5 sq. ft. Weight of engine, working order, 52 tons 2 cwts.; 15½ tons being on each pair of driving-wheels. Weight of tender, working order, 25 tons, carries 4 tons of coal, tank capacity 1,870 gallons. Wheel base, engine, 23 ft. 8 in. Engine and tender, 43 ft. 11¼ in. Total length, engine and tender over buffers, 54 ft., height, from rail level to center of boiler, 7 ft. 10½ in. Steam pressure, 175 pounds per sq. ft. This engine took the highest award made to foreign engines at the World's Fair.

The "999" has gone to California to the Mid-Winter Exposition, where she continues to be, as she was at Chicago, the "belle of the ball."

The pictures of "999" and the "British Train," on pages 71 and 72, are from photos by Mr. F. W. Blauvelt, and as we have had considerable enquiry for photos, especially of "999," he has, at our request, consented to place on sale both of the above photos and those of engines "1515" and "Jack the Ripper," published in our December number. The size of these photos is 8 x 10, neatly mounted, and copies of either or all of them can now be procured of H. O'Neil, photographer, 11 East 42d street, this city, for fifty-five cents each, to be enclosed with your order. Postage stamps are good. Don't write to us, write direct.

One of our correspondents suggests that a book compiled from the air-brake puzzles published in this paper would make a valuable book. Please make a scrap book of them, for we shall never do any book business of that kind—too much brain tissue called for. The air-brake articles now being published will cover the ground and will appear in book form later on.

We have no back numbers of anything except January, '94—no more bound volumes.

Not English Yet.

The following letter has been sent to the English *Engineer*, and is forwarded to us for publication, by Clement E. Stretton, C. E.

"The letter of Mr. F. L. Wanklyn is, in my opinion, calculated to mislead your English readers by causing them to suppose that the Pennsylvania Company has adopted a very English design of engine.

"A few years ago, when compounding first engaged attention in America, the Pennsylvania Railroad Company decided to very carefully test the question. A "Webb" three-cylinder engine was ordered from England, and is generally known as "Jack the Ripper," No. 1320.

"This has been followed by a Baldwin compound No. 1502, having six-coupled driving-wheels, No. 1503, a Schenectady compound, having six-coupled driving-wheels, No. 1510, a Baldwin compound, having four-coupled wheels, and the Pennsylvania Company itself has built a compound at Altoona, No. 1515, which is the one to which Mr. Wanklyn refers. It will thus be seen that the company has five experimental compound engines running on trial, but not one of them has been decided upon as the design for the future. In fact, the company's latest design is the class 'P,' No. 1659, described in my letter of recent date, which is the usual American design.

"Mr. Wanklyn speaks of the class 'T' engine No. 1515 as '*just turned out*,' implying that it is quite new, but this is not the case. In June last I went upon all the experimental compound engines at Altoona, including the one in question, No. 1515, and it had then been out a few months. I carefully examined the engine 1515, and have before me the official drawings I brought home, but fail to see anything of an English design in the engine. The six-wheeled tender has been adopted for this one engine so as to keep the total wheel-base of engine and tender right for turn-tables. The company's latest engines are all of the usual American pattern with the usual bogie tenders."

Egotism of Inexperience.

We are all familiar with the saying that the young brakeman talks as if he knew more about railroading than the general manager. This display of egotism by the novice is seen in all departments of life. A young military officer mentioned as a curious fact that he wore a smaller cap than he did when attending the military school at West Point. That is a common experience, remarked an older officer.

The brakeman who pretends to know more than the old man, the apprentice who is anxious to give his foreman information, the fireman who looks down upon the ignorance of the engineer, and the brake inspector who despises God for knowing too little about train mechanism are all amusing in their conceit, and they have peers and equals in every calling. In an address to students by the president of a university it was said, that a young writer could always be detected by his repeated use of the positive adverbs, while the veteran in science, schooled by experience, acknowledged the universality of error, made frequent use of the modifying clause and often introduced the element of uncertainty into statements.

A correspondent puts us straight, as follows: "In answer to R. C., Sedalia, Mo., you say the largest engine in the world works the Grand Trunk business in St Clair tunnel, near Detroit. Excuse me for the correction, but you will find that Detroit is about sixty miles from St Clair tunnel, as its terminals are Port Huron, Michigan and Sarnia, Ontario."

We cannot bind papers sent in. Patronize home industry.

THE "QUEEN-EMPRESS" ON HER ARRIVAL IN NEW YORK FROM THE WORLD'S FAIR

? A. What You Want to Know. ? A.

Don't ask questions that simply require a little figuring to determine, make each question separate. No notice taken of anonymous questions.

(15) Tinker, Portsmouth, Va., writes:

How can I case-harden small iron screws and other small parts, none of them being more than half an inch thick? *A.*—Put them in a cast-iron box bedded and covered with animal charcoal. Lute the cover of the box with clay and sand and keep it at a red heat for four or five hours.

(16) J. C. B., Des Moines, Ia., writes:

I have got up a very ingenious machine that would act as a brake to stop a car, and give out the power stored to help in starting. Can you tell me how to get parties interested in the invention? *A.*—There have been hundreds of devices of that kind patented and none of them are of any value. We do not think any business man would care to put money in it.

(17) F. H. D., Walnut, Texas, asks:

How much more power would it require to lift the water from well 100 feet deep, the discharge-pipe being 3½ inches, with pump-rods 1½ inches square, working inside of pipe, than if pipe was only 2 inches and pump-rod of ¾-inch pipe on same plunger. *A.*—The difference in power required would be the difference in the weight of water contained in the two sizes of pipe less the rods. Roughly speaking, in this case the larger pipe would contain about three times as much water as the smaller.

(18) Apprentice, Columbus, O., writes:

In reading mechanical papers I have often seen a worm mentioned, which is some mechanical thing. I do not understand what it is, and none of my friends can tell me. *A.*—There are several mechanical appliances called "worms." One is a double spiral used for drawing cartridges from firearms. The best known worm is a short revolving screw, which drives a shaft by engaging in gearing. If there is a Sellers' planer within your reach, you will find that a worm is employed to drive the bed.

(19) R. A. C., Topeka, Kan., says:

We had a dispute here lately about the effect that a light and a heavy rail has upon the power of a locomotive. Y says that LOCOMOTIVE ENGINEERING had an article saying that the pulling capacity of locomotives had been increased on some road when eighty-pound rails were put down in place of light ones. He could not find the article, and I hold that the statement is absurd. What do you say? *A.*—We say that Y was correct, and that we received the statement about the locomotives pulling heavier trains over the stiff rails from a perfectly reliable source.

(20) Ed. Schauss, Westbury, L. I., writes:

I wish to learn the machinist trade, and several advise me to take up electricity, in regard to it taking the place of steam, so would you please give your advice through your paper, as it may help others beside myself, and oblige. *A.*—It is entirely impossible to say what electricity may do in the future, but whatever it does, it will not make any difference with the machinist's trade. Mechanics will have to make electric machinery just as they make steam engines, electric motors, sausage stuffers and sewer traps now. Learn the machinist's trade, and keep your eye on electricity if you have a liking for it.

(21) W. H. S., Dennison, Ohio, asks:

1. If, in making an emergency application with the quick-action triple-valve the train-pipe is relieved of its entire pressure. *A.*—Not necessarily; a quick reduction of twenty or thirty pounds will apply the quick-action emergency. 2. In bleeding the auxiliary reservoir, the brake-cylinder is relieved of its pressure. I desire to know through what port the pressure leaves the brake-cylinder. *A.*—When the auxiliaries require bleeding it is because there is more pressure in the brake-cylinder and auxiliary drum than in the train-pipe; by "bleeding" the drum the pressure is reduced and the pressure in the train-pipe is allowed to move the piston of the triple-valve to release position.

(22) A. D. K., Colorado City, Col., writes:

1. Suppose you were waiting at a station for a train which does not stop, and this train passes 1 minute ahead of time, according to your watch, and your watch is 22 seconds slow; how much ahead of time is this train? I say 38 seconds, a friend says 1 minute 22 seconds. Who is right? *A.*—Your friend. 2. Suppose you were building two boilers, both of the same kind of steel, one very small and the other very large in diameter, both to hold the same pressure; would it be right to use the same thickness of material? *A.*—No. It is a matter of tensile strength per square inch of *area* in the shell sheets, and how many *square inches* are exposed to pressure. The U. S. Law gives this rule to determine thickness of boiler shell: "Multiply pressure by radius of the shell, and divide by one-sixth of the tensile strength of metal."

(23) School Graduate, Louisville, Ky., writes:

I have heard it stated that locomotives operated by compressed air have been successfully used in places where smoke and gases were objectionable. Can you give me any information on the subject? It seems to me that locomotives or motors of this kind would be cheaper and more reliable than electricity. Why not have several Westinghouse pumps on an engine of this kind, to keep up the pressure? *A.*—A pneumatic locomotive was tried on the elevated railroads of New York about twelve or thirteen years ago, and it did fairly well, but was more expensive than steam. We believe that the losses with an engine of this kind are greater than those of a good electric motor. The Westinghouse pump plan would not help any, unless there was some means of carrying power to work the pump. If air was taken from the tanks of the pneumatic engine, there would be loss instead of gain.

(24) E. W. D., Freeport, Ill., writes:

I have been reading the questions given on Educational Chart No. 1, 1894, and find some difficulty in satisfying myself as to the proper answer to question 25, first part. Does it (the piston) stop at each stroke? We might say it does, reasoning that it must stop to reverse its motion, and from the nature of the second part of question 25, I take it that this is correct, but it is not clear to me. I cannot yet see that it is correct, for the following reason: Let the crank-pin be a hair's breadth from the dead point, and a very slight degree of angularity exists in the main connecting rod, and the piston is a very slight distance from its position when crank-pin is on dead point. Now as the crank-pin does not come to rest on the dead point, in my opinion the piston does not come to rest at this point, not even the smallest period of time. *A.*—The piston must stop before it starts in the opposite direction, of course it does not loaf around the end of the cylinder long, but it stops at each end.

(25) W., Meadville, Pa., writes:

Please answer this question in your paper: How does the oil from the lubricator get through the pipes into the chests against the steam pressure when engine is working? There is a difference in opinion among some of us, some holding that the oil does not feed to cylinder and valve while engine is working. I say that either the oil goes into the chests by force of lubricator, or the pipes fill full of water, the same as feed glasses. *A.*—The oil pipes from the lubricator to the chests are open all the time, and there is an opening from the lubricator above the feed glass that admits a little steam to this pipe, and this carries the oil down the pipe to the chest. If the pipe filled with water, the oil would stay at the top until it finally filled the pipe full. There is no *current* of steam from the chests to the lubricator, but from the lubricator towards the chests the boiler pressure against the chest pressure if allowed time to equalize. When the engine is shut off there is a slight spray of steam flowing from the lubricator to the chests, carrying the oil with it.

The Fuel-Wasting Ash-Pan.

A part of the locomotive which has received too little attention from improvers is the ash-pan. If this humble part of the grand machine had received half the attention bestowed upon more ambitious features, many of the engines in use would be much more efficient than they are, and more fuel would be saved than what is effected by expensive changes in mechanism. The ordinary household stove ought to furnish an edifying object lesson on what is good and what is bad about the ash-pan of a locomotive. When the stove is in good order and all the openings that admit air beneath the fire in such a condition that the flow of air can be easily regulated, the stove is efficient, and gives a maximum of heat with a minimum expenditure of coal. When the casings and damper slides become distorted by the turmoil of hard usage, the stove falls into disrepute. Coal is thrown in without satisfaction, the grates are shaken, the regulators are tried in various shapes—all to no purpose. The stove burns twice the coal used at first, and does not appear to yield so much heat. All this disorder with the stove is due to the fact that the air cannot be regulated to suit the fire.

The locomotive furnace is merely a stove on a large scale. To get satisfactory results from the coal consumed, there ought to be means provided for regulating the supply of air to a locomotive furnace as accurately as to the fire of a stove. In the majority of locomotives, the appliances for controlling the admission of air to the grates are always in worse relative condition than those of a worn-out grate. When the engine is new, the ash-pan gives evidence that the maker never thought of making it air tight or of constructing the attachments so that the pan might be kept in shape and the dampers maintained in form, to be opened and closed readily. When wood was the prevailing fuel for our locomotives and the engines themselves were very small, an ash-pan made of sheet-iron was fairly satisfactory. With coal and heavy red-hot clinkers to be carried at times, with long grates to be spanned and irregular surfaces to be covered, the thin sheet-iron is still considered good enough for an ash-pan, and the roughest help in the shop deemed fine enough to put the fittings of an ash-pan together. It is no wonder that locomotives standing at stations create a dangerous nuisance by pop valves roaring and constantly blowing off steam. It is merely what might be expected to find engines burning about as much coal when standing in sidings as they do when pulling trains. We heard a traveling engineer talking lately about the strict practice he follows of disciplining engineers and firemen for permitting safety-valves to pop when engines are standing at stations. It occurred to us that the discipline was one-sided. It ought to be extended to those who are responsible for the ash-pans being no more air-tight than a market basket. That is the thing to hold responsible for the danger of screaming pop-valves and for the waste of fuel at times when combustion should be checked.

Elements of a Good Shop Foreman.

"One Who Has Been There," writing about the shop foreman, says that too great care cannot be exercised in the selection of a foreman, for upon his ability depends the financial prosperity of his department and the comfort of those working in the place. The first requirement of a good foreman is to know his business, but that is only the beginning of the list. Some of the men who have been the most conspicuous failures as foremen have been first-class workmen. It is not necessary that a man should be a particularly skillful mechanic to be an efficient foreman, if he only knows when work is well done, how it should be done, and the quantity that a good mechanic ought to turn out. A most important qualification for a foreman to have is the faculty of getting on well with workmen, keeping them in good humor while seeing that they all do a good day's work.

A shrewd foreman never discharges a workman for trivial causes, and always holds on to good workmen unless they have faults likely to demoralize the shop. It is a peculiarity of many incapable foremen that they let good men go and keep the shop full of inferior hands. The weak foreman is always regarding particularly bright men with suspicion, and these are not likely to find the shop agreeable. The foreman, superintendent or manager who is jealous of able subordinates are expensive officers and ought to be discharged. There are many of them to be found tyrannizing over subordinates and ruining the business of their employers. The officer who understands the interests of his employers does all in his power to have first-class men of every description around him. By doing so he strengthens his own position.

A foreman should realize that his workmen are entitled to respect, and he should conduct himself in such a manner that when he moves about among his men they will in duty bound show him all the courtesy due to his position. If workmen are treated with kind consideration, without harsh talk or profanity, they will acknowledge the foreman to be a gentleman, and act accordingly.

All operations in the shop should be carried on systematically, the material for machines under construction being ordered in time to prevent a moment's delay. The multitude of parts that make up a machine like a locomotive should be marshalled so that every piece is ready as required in erecting. Tools should never be seen lying on the floor or littering the benches. The tool-room is the place for them when not in use. Cleanliness and neatness are of the first consideration. A place for everything and everything in its place, is the first principle of order, and order is an essential element of success in doing work.

When a job is given to a mechanic, he should be permitted to finish it. One of the most demoralizing things for workmen is to keep moving them from job to job without finishing anything. It takes all heart out of the men, and cancels the pride of execution which does so much to keep up the high standard of manipulative skill. A foreman, by following the practices outlined, will make himself valuable to those who hired him, and popular with the men under his charge.

One of the first steam brakes to be regularly used upon a locomotive in the United States was designed by George W. Cushing, when he was master mechanic of the Chicago & Northwestern. He applied the brake to the locomotive "Minnie" in 1866, and it was the forerunner of that style of driving-wheel brake that shortly afterwards began to be seen on different roads.

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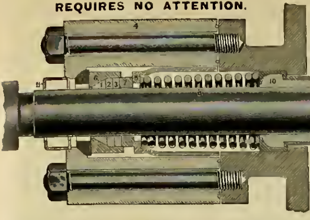

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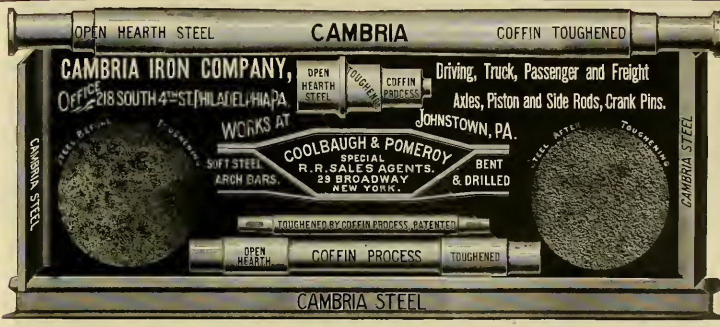

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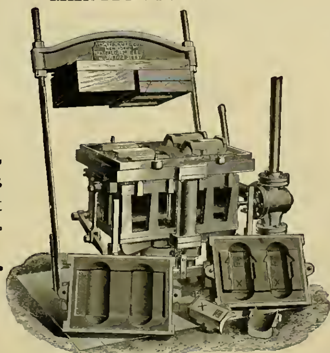

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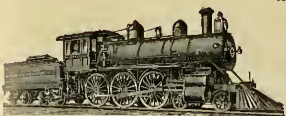

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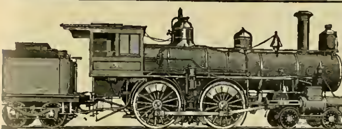

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NEW YORK OFFICE,

Nos. 31-33 Pine Street.

Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock.

VOL. VII, No. 3. NEW YORK, MARCH, 1894. 20 Cts. Monthly $2.00 Per Year.

Unnecessary Reduction of Employes.

One of our contemporaries which has been devoting a great deal of space and labor lately to arguing that railroad men of all classes are in duty bound to accept reduction of pay without a murmur, injects upon railroad officials the question "If you had to pay the salaries of all the men employed out of your own individual income, do you think there would be as many employed?" An attempt is then made to answer the question in the negative. We believe that we have enjoyed as good opportunities for observing the conditions of employment on railroads and in private firms as any person connected with the *Railway Age*, and the result of our observations is that we consider that railroad officers as a rule are less given to retaining superfluous help than any other kind of employer. A private employer, whose individual income suffers most severely in hard times, will often keep on old employés when there is little for them to do, partly through benevolent instincts and partly because it is good business policy to retain valuable men. In the course of numerous tours made during the last three months, we have been greatly impressed with the sympathy that private employers display towards those dependent upon them, and with the number of manufacturing establishments that are kept running with the expenses greater than the income. This is done for the purpose of providing a livelihood for the workmen under circumstances when it would be money in the pockets of the employers to close down the works.

We regret to say that we have seen very little of this benevolent spirit among railroad officers. They are hounded so with orders to reduce expenses that they appear to have no bowels of compassion. Those who perceive that they are losing valuable men who will be hard to replace when business revives, and understand that the policy will be costly in the end, perform the acts of harshness because they have no option in the matter. To the manipulator of stocks, the individual employé is a mere machine. Supply and demand is his highest law, and he cares nothing for depriving men of employment. Men of this stamp give orders that operating expenses of railroads be reduced, and the executive officers have to obey or get out.

The present lamentable depression of business has been greatly intensified by this tendency of railroad stock owners and gamblers to reduce operating expenses, and stop purchasing everything not absolutely required to keep trains going. It is the most short-sighted kind of business policy, and ultimately causes increase in the expense necessary; but those who pursue it care for nothing but the present, and their acts exert disastrous influence upon the welfare of the whole country. There is certainly no reason to find fault with the men in charge of railroad operating for keeping at work men whose services might be dispensed with. The cause for regret is all in the opposite direction.

The Shoe Fitted.

We have had a rather amusing experience lately, which brings to mind some incidents connected with one of Dickens's novels. Readers of fiction will remember that in "Nicholas Nickleby," Dickens assailed the outrageous condition of the private schools by describing the educational methods of Mr. Whackford Squeers of Dotheboys' Hall. The pictures of the schools and schoolmasters of the day were so faithfully drawn, that the novelist was threatened with suits for damages by the proprietors of several different educational seminaries. We wish to tell how faithfully history repeats itself.

In our last issue we published an article headed, "Trying to Change the Methods of Railroad Purchasers," in which we told of efforts made by various manufacturers of railroad supplies to make the purchaser the servant of the seller. The facts recorded were ingenuous confessions of different men who were perfectly sincere in thinking that purchasers ought to do all in their power to accommodate the seller. Since the article was published, which is now two weeks ago, we have had complaints from three parties that we had been very unkind to make their business methods the subject of an article. None of the firms whence this complaint came had been in the mind of the writer when he was preparing the article. It looks as if the practices objected to were even more prevalent than we were aware of, and the indications are that the parties pursuing them have an uncomfortable impression that they are on the losing side.

Ready for Business—Lake Street Elevated Railroad, Chicago.

The Lehigh Valley Railroad Company have made a change in their method of charging meals in their dining cars. Instead of charging the hard and fast dollar for a meal, they supply eatables according to a bill of fare and charge accordingly. The patrons of the road talk very favorably about the change, and the indications are that this plan will become so popular that all railroad companies running dining cars will be compelled to adopt it.

The Elements of Boiler-Making.

By C. E. Fourness.*

In starting this series of articles on boiler-making, I will try and start at the bottom round by first defining the circle and its sections, also define cones, cubes, prisms, cylinders, spheres, etc.

1—The radius of a circle is a straight line drawn from the center to the circumference, as *C D*.

2—The diameter of a circle is a straight line drawn through the center and terminating at the circumference, as *A C B*.

3—The circumference of a circle is a curved line, every point of which is equally distant from the center, as *A H K I B D G A*.

4—A chord is a straight line joining any two parts of the circumference, but not passing through the center, as *H J I*.

5—The versed sine of a circle is a perpendicular line joining the middle of the chord to the circumference, as *J K*.

6—An arc of a circle is a portion of the circumference, as *D B*.

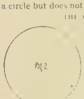
7—A semi-circle is one-half the circumference cut off by the diameter, as *A G D B C A*.

8—A segment of a circle is any portion of a circle cut off by a chord, as *H J I K H*.

9—A sector is a part of a circle cut off by two radii, as *B C D*.

10—A tangent is a line that just touches a circle but does not cut it as, *E G F*.

THE CIRCLE.



The circle is a plane figure bounded by a curved line, every part of which is equally distant from the center.

Rules in relation to the circle.

1—Multiply the diameter by 3.1416, the product is the circumference.

2—Multiply the circumference by .31831, the product is the diameter.

3—Multiply the diameter by itself (or square the diameter) and then multiply by 7854, the product is the area.

4—Multiply the square root of the area by 1.12837, the product is the diameter.

5—Multiply the diameter by 8862 the product is the side of a square of equal area.

6—Multiply the side of a square by 1.128, the product is the diameter of a circle of equal area.

Application of rules in relation to the circle.

1—Wishing to make a tank 38 inches in diameter, what would be the circumference required?

38×3.1416=119.3808. We now have 119 inches and 3808 parts of an inch. As less than one-eighth of an inch does not amount to much in the circumference, we will reduce this decimal to one-eighths by multiplying by eight, 3808 × 8 = 3.0464 or three-eighths of an inch.

The circumference of a circle 38 inches in diameter, equals 119⅜ inches.

2—Having a sheet of iron 130 inches long, what diameter of shell will it make? First take off 2 inches for laps, we have then 128 inches, which multiplied by .31831 equals 40.7436, or 40¾ inches in diameter.

3—Find the grate area of an upright boiler, the firebox being 3 feet in diameter. 3×3×.7854 equals 7.06 square feet, the area.

4—The opening on top of the smokebox or breeching has 240 square inches, find the diameter of smokestack which contains that area.

Extract the square root of 240, which equals 15.489. 15.489 × 1.12857 = 17.477 inches in diameter.

5—A man has a tank 36 inches in diameter, which he wishes replaced by a square one of equal capacity. Find side of a square equal in area, 36 in × .8862=31.9, length of side required.

6—I want to replace a square tank by a round one of equal area. The old tank is 48 inches square. Find the diameter 48×1.128=54.144 inches in diameter.

1—To find the area of a sector.

Rule—Multiply the length of the arc by half the length of the radius, the product equals the area.

Example—Find the area of a sector, the arc being 9½ inches long and the radius 7 inches long. 7÷2=3.5×9.5=33.25 square inches, area.

2—To find the area of a segment.

Rule—Find the area of a sector whose arc is equal to that of the given segment, then subtract the area of the triangle formed by the chord and radius, the remainder equals the area of the segment.

Example—Find the area of a segment, the length of the arc is 9¼ inches, the radius 7 inches, the chord 8.33 inches, and the perpendicular 3.75 in. 9.75 × 7 ÷ 2 = 34.125—(8.33×3.75÷2) = 15.6.

CONCENTRIC CIRCLES.

Meaning one circle within another, and equally distant from each other at all points, or two circles with one common center.

3—Find the area of the space between two concentric circles.

Rule—Multiply the sum of the inside and the outside circles by their difference, then by .7854, the product equals the area.

Example—Find the area contained in the space between two circles, one 32 inches in diameter and another 28 inches in diameter.

$$\frac{32+28=60}{32-28=4}\ 60\times4\times.7854=188.49.$$

ELLIPSE.

An ellipse or oval is a curved line which returns into itself like a circle, but has two diameters of unequal length, the longest of which is called the transverse, and the shorter the conjugate axis.

1—Find the circumference of an ellipse, or oval.

Rule—Multiply half the sum of the two diameters by 3.1416, the product will be the circumference.

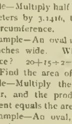
Example—An oval is 20 inches long by 15 inches wide. What is the circumference? 20+15÷2=17.5×3.1416=54.97.

2—Find the area of an ellipse or oval.

Rule—Multiply the two diameters together, and the product by .7854, the quotient equals the area.

Example—An oval, 20×15 inches, require the area. 20 × 15 × .7854 = 235.62 square inches.

TRIANGLE.



A triangle is a plane figure bounded by three sides and having three angles.

Two sides of a triangle being given to find the third.

1—Before raising a smokestack I wish to find the length of the guy-rods. The guy-band is 30 feet from the bottom of the stack, and the posts or anchors for guy-rods are 25 feet from the base of the smokestack.

Rule—Add the square of the base to the square of the perpendicular, and the square root of the sum is the hypothenuse or length required.

$$30^2=900 \quad 25^2=625 \quad 1525 \qquad \sqrt{1525}=39.05 \text{ feet.}$$

length of guy-rod required.

2—On another smokestack the guy-band is 30 feet from the bottom and I have 165 feet of wire rope for guy-rods. How far must I set the anchors from the base of the smokestack?

Rule—Subtract the square of the perpendicular from the square of the hypothenuse, and the square root of the quotient equals the base.

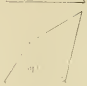
Example—If I have 165 feet of wire rope, as there are four guy-rods in this case, I will have one-fourth of 165 feet, or 41¼ feet for each; as I will need about 1½ feet for attaching to band and anchors, I will have 40 feet for hypothenuse or rod.

$$40^2=1600 \quad 30^2=900 \qquad \sqrt{700}=26.45$$

TRIANGLES.

3—To find the area of a triangle.

Rule—Multiply the base by one-half the altitude, the product equals the area.



Example—Find the area of a triangle whose base is 14½ inches long and the altitude is 6¼ inches long. 14.5×(6.25÷2) = 90.625.

4—The above rule is very convenient for finding the area of any irregular figures formed by straight lines, as the example. Divide the figure into triangles and find the area of each; then add together.

CONES.

A cone is a body having a circular base and whose convex surface tapers uniformly to a point called the vertex.

1—To find the convex surface of a cone.

Rule—Multiply the circumference of the base by the slant height and one-half the product equals the convex surface.

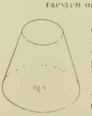
Example—Find the convex surface of a cone 6¼ inches in diameter at the base, and whose slant height is 18¾ inches. 6.25 × 3.1416 = 19.635 in the circumference of the base. 19.635 × 18.75 ÷ 2 = 184.07 square inches, the surface required.

2—To find the solid contents of a cone.

Rule—Multiply the area of the base by the perpendicular height, and one-third of the product will equal the volume.

Example—To find the volume of a cone, the diameter at the base being 15 inches and the perpendicular height being 32½ inches. 15^2×15×.7854×32.5÷3=1914.41 cubic inches.

FRUSTUM OF A CONE.



The frustum of a cone is that part that remains after cutting off the top by a plane, parallel to the base.

1—To find the convex surface of a frustum of a cone.

Rule—Add the two circumferences together, then multiply by one-half the slant height.

Example—Find the convex surface of a frustum of a cone 25 inches in diameter at the bottom and 10 inches in diameter at the top and the slant height 30 inches.

25×3.1416=78.5, circumference of the base.

10×3.1416=31.425, circumference of the top.

78.5+31.425×(30÷2)=1648.87.

2—To find the volume of a frustum of a cone.

Rule—To the sum of the areas of both bases, add the square root of the product and multiply this sum by one-third of the altitude.

Example—Find the solid contents or volume of a frustum of a cone, whose altitude is 6 feet and the diameter of its bases 4 feet and 3 feet.

$$\frac{4\times4\times.7854=12.56}{3\times3\times.7854=7.06}\ \frac{}{19.62}\ \sqrt{19.62}=4.42+19.62\times2=48.11 \text{ cub. ft.}$$

THE SPHERE.

A sphere is a body bounded by a uniform curved surface, all the points of which are equally distant from a point within called the center.

1—To find the surface of a sphere.

Rule—Multiply the square of the diameter by 3.1416, the product equals the surface.

Example—Find the surface of a globe 9 inches in diameter. 9×9×3.1416=254.469 square inches, the surface required.

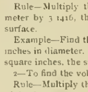
2—To find the volume of a sphere.

Rule—Multiply the surface by one-sixth of the diameter.

Example—Find the volume of a sphere 9 inches in diameter. 9×9×3.1416=254.469×(9÷6)=381.7 cubic inches.

A point has no dimensions, a line has length, a surface has length and breadth, a solid has length, breadth and thickness.

SQUARE.



A square is a plane figure, bounded by four straight equal and parallel lines, and has four right angles.

1—Find the surface or area of a square.

Rule—Multiply the length by the breadth, the product equals the surface.

Example—Find the area of a square 18 inches square. 18×18=324 square inches the surface required.

RECTANGLE.

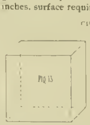
A rectangle is a plane figure bounded by four straight parallel lines, and whose angles are right angles.

1—Find the surface of a rectangle.

Rule—Multiply the length by the breadth, the product equals the surface.

Example—Find the surface of a rectangle 4 inches by 10 inches. 4×10=40 square inches, surface required.

CUBE.



A cube is a solid whose six faces are all equal squares.

1—Find the surface of a cube.

Rule—Find the surface or area of one face, then multiply by the number of faces.

Example—Find the surface of a cube 9 inches long, 9 inches wide and 9 inches high. 9×9=81 square inches, the area of one face. 81×6=486 square inches, surface of the cube.

2—To find the solidity of a cube.

Rule—Multiply the length by the breadth and thickness, the product equals the solidity.

Example—Find the solidity of a cube 9 inches long, 9 inches wide and 9 inches high. 9×9×9 = 729 cubic inches, the solidity.

PRISMS.

A prism is a solid whose ends are equal and parallel, similar polygons, and whose sides are equal and parallel.

1—Find the surface of a square prism.

Rule—Add the area or surface of the sides and ends together, the sum equals the surface.

Example—Find the surface of a prism 6

*Foreman Boiler-maker, C., M. & St. P. Ry., Dubuque, Iowa.

inches wide, 6 inches thick and 16 inches long.

6×6=36, area of one end.

6×16=96, area of one side.

96 times 4, the number of sides = 384

36 times 2, the number of ends = 72

456

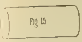
square inches, the surface required.

2—Find the solidity of a square prism.

Rule—Multiply the length by the breadth and thickness, the product equals the solidity.

Example—Find the solidity of a square prism, 10×10×24 inches. 10×10×24=2400 cubic inches solidity.

CYLINDER.



A cylinder is a solid bounded by a uniformly curved surface, its ends being equal and parallel.

1—Find the convex surface of a cylinder.

Rule—Multiply the circumference by the length, the product equals the convex surface.

Example—Find the convex surface of a cylinder 6 feet in diameter and 12 feet long. 3.1416×6×12=226.08 square feet, the convex surface required.

2—To find the solidity of a cylinder

Rule—Multiply the area of the end by the length, the product equals the solidity.

Example—Find the solidity of a cylinder 6 feet in diameter and 12 feet long 6×6×.7854×12=339.24 cubic feet, the solidity.

That Angle-Cock.

We have received a flood of correspondence offering cures for that scapegoat—the angle-cock—that is always getting turned wrong. A great many of these are electric bells and wires, connections that have to be made *beside* coupling up the hose. Improvers should not lay everything to the tramp. There is no doubt whatever that in nine cases out of every ten where angle-cocks have been found wrong, they have been left that way by careless or incompetent trainmen. Surely if such a man has two connections to make under the car in place of one, he will make twice as many mistakes. The malicious person and the tramp may have done their work, but we are inclined to think they are being overworked in this angle-cock business.

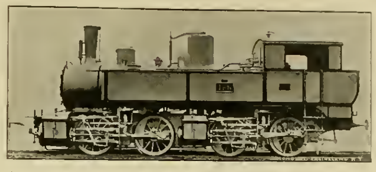
Some one will yet devise some simple improvement—like a hole or a valve—in the present apparatus that will give warning when any cock in the train is turned wrong, and this will be done without extra parts to handle. On passenger trains this is a simple problem of some connection between the brake-pipe and signal-pipe, but on freight trains it will probably be a valve that will set the brake when the cock is turned wrong. Anything that calls for making extra connections or turning extra cocks will be a source of more danger than safety, because men will depend on them to do something that they can't do.

The management of the East Tennessee, Virginia & Georgia have displayed good faith toward their employés and adherence to a verbal agreement, which is in strong contrast to the action of not a few other railroad managers. Four months ago, when times seemed to be at their worst, the management was compelled to reduce the wages of trainmen, and the promise was made that the old pay schedule would be restored on February first. When last month came round it was found that business was decidedly worse than it was when the cut took place, but the company kept the agreement, although they calculated to a certainty that the business of the road would be sufficiently imprved to bear the increased pay roll without embarrassment. We feel certain that the trainmen will show their appreciation by doing their best to reduce the consumption of supplies in every way possible, and thereby, in a measure, reduce the aggregate expenditure.

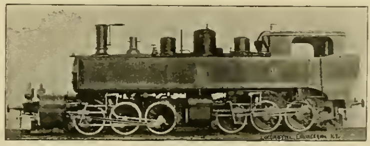
Duplex Compound Engines on Swiss Mountain Roads.

BY HENRY GREFFNER.

These engines are composed of two distinct groups of twin steam engines—a high and a low-pressure one—arranged under a common locomotive boiler. The high-pressure engine with its frame is made in a fixed connection to the boiler, while the low-pressure engine, placed at the front end, is made to swivel under the boiler. Thus, the high-pressure steam pipes leading from the boiler to the respective cylinders are made a fixture, like in ordinary locomotives, and there is only a movable pipe, forming the receiver, connecting the two-cylinder systems; also a movable pipe leading from the low-pressure cylinders to the blast-pipe.



The two steam engines proper are built with outside cylinders and motions, and are mounted on an equal number of coupled axles. As the front engine is made to swivel under the boiler, the framing of the locomotive is made of two distinct parts, in such a manner that the front framing is coupled or articulated to the hind framing by means of a strong vertical hinge. The hind or main framing, which carries the firebox, is curved upwards over the front engine, and supports likewise the boiler shell and water tanks, while the framing itself rests by means of suitable slides upon the front engine framing, which is thus enabled to move freely in a horizontal direction. In order too prevent too great a mobility of the front engine, there are a pair of check springs put in, bearing against a support underneath the smoke-box.



The valve motions of both engines are made identically alike in all their parts. The stationary links are of the "Walschaert" type, and as the volumes of the high and low-pressure cylinder systems are proportioned for an equal admission of steam, the reversing of the duplex locomotive is effected by a simple screw, as in ordinary engines. The reversing screw acts upon a lever, commanding the motions of the hind or high-pressure cylinders. From this lever, and by means of an intermediate lever and shaft, fixed in the prolonged main framings, also by an articulated tie-rod, the lever commanding the low-pressure cylinder motions is actuated upon.

The steam pressure in the receiver is limited to 70 pounds and safety-valves being provided to prevent the accumulation of a higher receiver pressure. If necessary, the starting of the engine can be facilitated at certain positions of the high-pressure pistons, by admitting live boiler steam to the receiver, and this can be done automatically by connecting the auxiliary steam-cock with the reversing gear.

It is claimed that, as compared with ordinary engines, the duplex locomotives have effected a saving of from 15 to 22 per cent. of coal by working the same trains and loads.

No. 151, of which a single engine has been built only, so far, runs on the Gotthard Railroad. Its principal dimensions are: Boiler pressure, 177½ pounds (12 atm.), high-pressure cylinders, 15¾ in., low-pressure cylinders, 22⅝ in. stroke, 25 3/16 in.; tractive force, 19,810 pounds, heating surface of firebox, 100 square ft., heating surface of tubes 1,568.3 sq. ft., total heating surface 1,668.3 sq. ft., grate surface, 23.7 sq. ft., drivers, 48½ in. diam., distance between buffers, 45 ft 2⅓ in., total wheel base, 26 ft. 7¼ in., total weight, with full provisions, 187,220 pounds; weight, when empty, 147,577 pounds; water, 15,419 pounds, coal, 9,470 pounds. The engine is fitted with hand-brake and "Hardy" brake.

Of No. 186 there are six pieces running on the Central Railroad, built in 1891. The principal dimensions are: Boiler pressure, 177½ pounds, high-pressure cylinders, 14 in. diameter, low-pressure cylinders, 21⅛ in., stroke, 25 5/16 in., tractive power, 14,977 pounds; heating surface of firebox, 87.2 sq. ft., tubes, 1,165.7 sq. ft., total, 1,252.9 sq. ft.; grate surface, 19.6 sq. ft., drivers, 4 ft. 2⅓ in.; distance between buffers, 37 ft. 6⅝ in.; total wheel base, 20 ft. 4 in.; total weight, with full provisions, 129,960 pounds, weight, empty, 105,700 pounds; water, 11,010 pounds; coal, 4,400 pounds.

Since these machines were put in service another order for ten more of the same type and about the same dimensions has been given by the company, and these are just now being delivered.

No. 6 is a narrow gauge engine, 3 ft. 3⅜ in. (1,000 mm.) between the rails, and runs on the Landquart-Davos line. Two have been built of this kind, and their principal dimensions are: Boiler pressure, 177½ pounds, high-pressure cylinders, 13 in.; low-pressure cylinders, 19 5/16 in.; stroke, 21⅝ in., tractive force, 13,200 pounds, heating surface of firebox, 65.7 sq. ft.; tubes, 797.6 sq. ft., total, 863.3 sq. ft., grate surface, 15.5 sq. ft., drivers, 3 ft. 5¼ in., distance between buffers, 33 ft 2⅓ in., total wheel base, 15 ft. ½ in.; total weight, with full provisions, 89,200 pounds, weight, empty, 71,600 pounds, water capacity, 7,710 pounds; coal, 2,200 pounds.

Besides the above-mentioned engines of the duplex type there are six more running on other roads in Switzerland, so that the total number in that country is now twenty-five, of which eight are narrow gauge (3 ft. 3⅜ in.). They have all been built by J. A. Maffei, in Munich.

Zurich, Switzerland.

Curious Results of a Test of Metal Rope Fastening.

At the Scranton shops of the D., L. & W. they recently made some tests of wire rope and fastenings for it. One and a half inch steel cables are used in some of their mines, and these tests were made to determine whether or not the fastenings were as strong as the cable. Sockets with taper holes, known as rope cones, to receive the rope, and ending in a fork to fasten to the cage, are used. The rope is passed through the hole and the ends of the wires turned back, making a bushy head, into this mass of twisted and doubled wire they pour lead or babbit metal.

The pieces were tested in their regular wheel press. It was soon proven that the rope was amply strong, sustaining seventy tons with no other effect than a reduction of diameter owing to the compression of the soft center. Lead proved very soft for fastening the wires—they pulled through it; a composition composed of three parts lead to one part antimony, did far better.

The forks sustained load enough to bend steel pins 2 inches in diameter before breaking, but when they did break a curious thing happened—one side of the fork broke *in two* places, and a piece about an inch long dropped on the floor; this happened when the load was about seventy tons.

The cross-section of metal was the same where each break occurred—but why should two occur?

Engine No. 10, on the Indiana & Illinois Southern R. R., was bought from the T. H. & I. R. R., in June, 1887. When she went there her valve-stems were packed with Killmore packing. The left hand one chattered and did not work true, and the packing on that side would blow. It was taken out in about six months and packed with hemp; that stem has since been replaced with a new one. The right hand one has never been touched, except to put in a little filler of hemp or rubber about three or four times since, and occasionally tighten the gland up a little—a period of over six and a half years. This engine has been on freight almost every day. If that packing is still made why don't some one know of it?

Michael Dunn, formerly round-house foreman, has been appointed general foreman and road foreman of engines of the Cincinnati division, Penna. System, with headquarters at Cincinnati.

*Diseases of the Air Brake System; Their Causes, Symptoms and Cure.

By PAUL SYNNESTVEDT.

Engineer's Brake-Valve.

Before going into details as to the difficulties that arise in the use of the engineer's brake-valve, it will not be inappropriate to say a few words as to the different styles that have been and are now in most general use.

THREE-WAY COCK.

The first form used with the automatic brake was an ordinary three-way cock, the ones that had been used for straight air being made to do service by using the handle in the reverse positions. This cock was simply a brass valve with three connections, one from the main drum, one to the train-pipe, and one an exhaust to the atmosphere. In one position of the handle, called the release position, there was communication between the main drum and the train-pipe, the exhaust being closed; in another position of the handle, called the application position, the exhaust from the train-pipe was open, the communication from the drum being shut; while the third position was midway between these two, and as it blanked all the ports, it was termed the "lap."

These three positions form the foundation for nearly all the engineer's valves since designed to operate automatic compressed air-brakes.

The main difficulty with the old three-way cock was that it had such a large port opening as to make too sudden a reduction when a service stop was desired. Another trouble was, that unless closed with very great care the stoppage of the opening was very apt to release the head brakes from the recoil of the train-pipe pressure.

Besides this there was no provision in the original three-way cock for storing any excess pressure in the main drum, and this made it difficult at times to properly release the brakes.

This old valve being in the shape of a plug-cock, was very liable to leak after a short period of service, as grit and dirt which got into the valves would cut grooves around the bearing. If it was screwed together too tightly it was very hard to move, and if it was left loose it was constantly leaking.

BRASS ENGINEER'S VALVE.

The next valve to come into general use was a small brass valve with a rotary disk as the main operative part. This had an excess pressure valve and a spring device for cushioning the valve, which cut off the exhaust of air in applications of the brakes. This valve had several springs in it which gave considerable trouble from weakening, and one which bothered considerably because of the corrosion making it brittle and stiff. The one which weakened the most was that which was placed just above the main or rotary valve, or more accurately, just within the head of the handle, and the result of this was to cause leakage in the train-pipe in the running position or on "lap." The excess pressure valve was the one which bothered by getting corroded, and this was because this was placed right in the center of the main body of the valve, and arranged in such a way as to be exposed to all the oil and water.

Strange as it may seem, this small valve, the one requiring cleaning and repairs most frequently, was placed in the position most difficult to reach. To get it out required the taking apart of the whole valve.

EQUALIZING DISCHARGE-VALVE.

Following the second one came the equalizing discharge-valve, and this we have shown on plates 8, 9 and 10, as it was first put into most general use. The modified form now supplied by Westinghouse, of which we shall treat later, is, in most respects, the same in principle, the main difference being in the use of a feed-valve instead of an excess pressure valve.

The parts of this valve most frequently requiring attention are, the rotary-valve 13, excess pressure valve 21, and equalizing piston 17. These should all be taken out frequently and cleaned.

OILING PARTS.

The rotary and piston should be carefully oiled before replacing, some oil which will not gum being the best to use. In selecting an oil it must be remembered that when the valve stands near the boiler head it is subject to considerable heat, and any oil which dries rapidly is not suitable under such circumstances. The piston 17 seldom gives much trouble unless too much oil is being used in the air cylinder to the pump, in which case gum will collect around the valve-seat and reduce the size of the opening.

BLOW FROM EXHAUST.

A constant blow out of the exhaust opening indicates dirt on the seat of this discharge-valve, and, if it does not blow out on a heavy reduction in the train-pipe, will necessitate the removal and cleaning of the piston.

An intermittent blow when the handle is on the lap indicates a leak somewhere around the cavity above piston 17, or the pipe connections to the small reservoir or train-pipe gauge.

A leak around any of these connections acts the same as a slight reduction in service stop position, causing the graduating piston to raise and open the train-pipe exhaust until train-pipe pressure is reduced below that in the cavity, when the valve will seat again.

A very small leak around any of the connections mentioned will cause quite a blow when the valve handle is on the "lap," because of the limited quantity of air contained in the small cavity and equalizing reservoir, and the fact that when the handle is on the "lap" all supply to this part is cut off. In the running position this blow will not show, because the equalizing port (*c*) from the train-pipe to the cavity (*D*) is open, so that the train-pipe loses pressure as rapidly as the cavity.

LEAKS AROUND CAVITY.

Leaks from this cavity are very apt to occur around the joint of the gasket (22) between the two parts of the valve, especially if the valve stands very near to the boiler-head, as the heat dries the leather and makes it contract. Generally this can be remedied by tightening up the four nuts that hold the valve together, although sometimes it is necessary to put in a new gasket.

To become convinced of the importance of keeping all joints around this valve and the gauges tight, it is only necessary to experiment on a valve by *making* a leak (loosening the union connection to the small reservoir, for instance), and, with the handle on the "lap," examining the blow that will come out of the train-pipe exhaust.

This blow will, of course, be much heavier on a long train than a short one.

CLEANING ROTARY.

As stated above, it is necessary to fre-

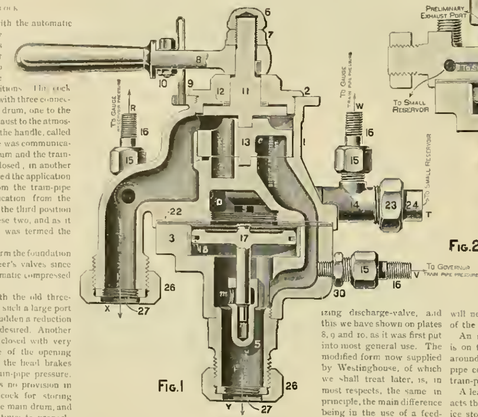


Fig. 1

Plate 8.

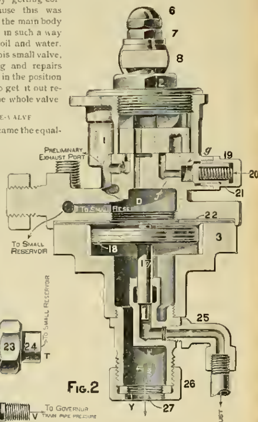


Fig. 2

Plate 9.

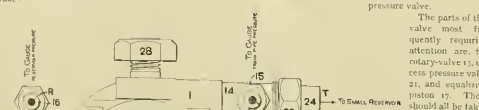


Fig. 3 Fig. 4

Plate 10.

quently take out the rotary-valve and clean it, and to do this it is necessary to let all the air out of the main drum, as that pressure bears against the top of the rotary-valve all the time There are two convenient ways of doing this. One is to remove the valve handle so that the spring will not interfere, and then turn the handle

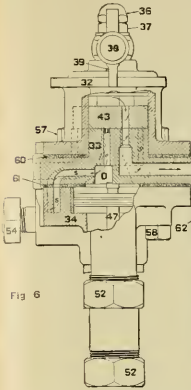
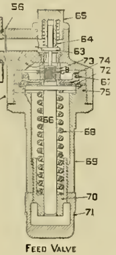


Fig 6



FEED VALVE

PLATE 11

upside down on the square and move it to a position about opposite the "lap," or, if there is not room for the handle to clear, use a wrench. Another is to leave the valve handle in the release position and go to the back of the tender and open the hose-cock

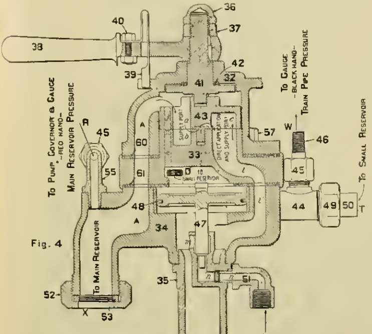


Fig. 4

PLATE 12.

DEFECTIVE HANDLE SPRING.

There is one point about the engineer's valve which is very frequently neglected, notwithstanding it is of great importance. It is the handle spring No. 9 which fixes the positions of the valve.

From violently striking the notch in release or emergency position this often gets bent or works loose, so that when apparently in the running position the ports may actually be lapped. When left in this position for some time the train-pipe pressure may reduce to such a degree as to be of little account for an emergency stop, and a serious wreck may be the result. In fact a number of serious wrecks have been attributed to this very cause, cases in which, as the papers say, "the air-brakes failed to work," simply because there was not sufficient air in the pipes to work them. The author has seen engineer's valves in operation on which the spring was broken or missing, and the engineer had to guess when his handle was in the running position. Of course, in examining the spring the quadrant should also be examined to see that the notches are sufficiently accurate and abrupt, and no one should alter these notches because the "excess pressure does not work right" unless perfectly sure that the ports do not register correctly.

EXCESS PRESSURE

Now that we have touched on the excess pressure valve, let us say a few words more about it, and then consider the change that has been made in the latest valve by the substitution of the feed-valve in its place. The excess pressure valve shown on plate 9, No. 21, requires frequent removal and cleaning. If there is too much or too little excess the valve should be taken apart and cleaned, after which it should be put in place and tried before anything further is done, as there may be no other trouble. To get at it most readily leave the handle in the service stop notch, with the train pipe shut off either under the valve or back of the tender, in case there is no stop-cock in the train-pipe in the cab, when it will not be necessary to bleed the main drum. Twenty pounds is generally recommended as the proper amount of excess pressure to carry, and this is a good average.

The author prefers, however, to vary it according to the service in which the engine is running. In suburban service, where the trains are short, from 5 to 10 pounds is ample, while on long freight trains 20 is not too much. Where frequent stops are make, requiring considerable air, much excess will make it difficult to keep the train-pipe pressure up to the proper point on the valves we are now considering, which do not feed the train-pipe at all until the excess is pumped into the drum.

Under the head of Governor, will be found the explanation of the alternate in-

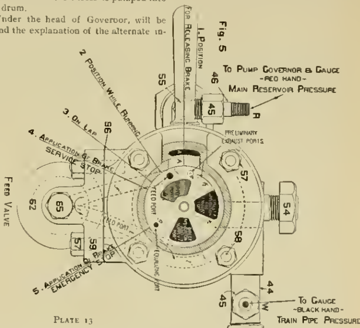


PLATE 13

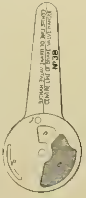
crease and decrease of excess pressure so often noticed after the train-pipe pressure has reached the limit at which the governor is set. *This* difficulty is not due to any defect in the excess pressure valve at all, and it is only a waste of time to take the engineer's valve apart in endeavoring to remedy it

TOO RAPID FALL OF GAUGE POINTER IN SERVICE STOPS.

If it is noticed on any valve that the gauge pressure reduces *very* rapidly when the handle is placed in the service stop position, it is a sure indication that there is some obstruction in the connection from the valve to the equalizing reservoir or that the reservoir is nearly full of water. Anything which will tend to decrease the capacity of the air in the cavity above the equalizing piston will produce this effect To experiment on this, put a blind gasket in the union connection between the valve and little reservoir, when the handle can hardly be moved to the service stop position without losing all the gauge pressure at once.

TOO SLOW REDUCTION OF GAUGE PRESSURE IN SERVICE STOPS

If the pressure on the gauge reduces too slowly in service stop applications, it is generally an indication that the small equalizing discharge port is partially closed by gum or dirt and should be cleaned out. The same effect would be produced by having too large an equalizing reservoir, and the difficulty would be aggravated in direct proportion as the capacity of this reservoir was increased. The author once saw an engine on which a 12 x 33-inch reservoir had been placed because the small equalizing reservoir had not been sent



with the valve. The engineer very justly complained that his brakes were very slow to set, until finally the proper drum was put in place. It should be understood that the discharge-port and little reservoir bear a certain proportion to each other, and any change in either will be pretty sure to result in trouble.

FEED-VALVE.

The feed valve (Plate 11), which has been substituted for the excess pressure valve in the latest form of the engineer's valve, is nothing more or less than a pressure regulator controlled by the amount of air in the train-pipe. It is generally set at 70 pounds, as this is the standard on most roads. It is controlled by a diaphragm actuated by a spring on one side and the train-pipe pressure on the other, and stays open until the train-pipe pressure has accumulated the limit of pressure, when it closes and allows the excess to be pumped into the main drum.

With this construction the governor, set at 90 pounds, is attached directly to the main reservoir, as the feed-valve prevents the train from accumulating over 70 pounds in the running position.

With the feed-valve it is impossible to have any excess pressure until the train has accumulated its 70 pounds, as, up to that time, there is an open passage from the drum to the train-pipe in the running position as well as the release, the only difference being that the port which is uncovered in the running position is smaller than that used in the release

With a clear understanding of the principle of operation there ought to be very little difficulty in locating any defects that may arise in the operation of the device.

CARRIES TOO MUCH AIR.

If the train-pipe accumulates more than 70 pounds in the running position, it is very evident that air must be passing from the drum into the train, but the conclusion must not be hastily made that this is due to a defect in the feed-valve, for it may be, and not infrequently is, caused

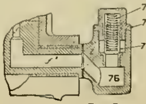


Fig. 8

PLATE 14.

by an imperfect gasket between two of the main portions of the body of the valve. This is most apt to occur in gasket 61 just at the point to the right of the passage in which Fig. 61 stands in Plate 12, at which place it will be noticed there is a very narrow bearing.

Leakage by this gasket will be manifested in still another way much more troublesome than a mere increase in the train-pipe pressure.

SLUGGISH ACTION OF BRAKE IN SERVICE.

It will prevent either partially or entirely the application of the brakes in service position. This is because the pressure in the cavity *D* will not reduce with sufficient rapidity through the small preliminary exhaust port if air is leaking from the main drum into the cavity at the same time.

To go back now to the increase of pressure in the train-pipe.

This may be due to trouble with the feed-valve. It is possible it may not be properly adjusted, or if it is all right in that respect it may be found to seat imperfectly. This may be due to some bend or defect of a similar nature in the small spindle of the valve 64, or possibly merely dirt on the seat of this valve. In a case of this nature it is hard to determine which is the most promising field to investigate first. If in service application the reduction in cavity *D* is found to be slower than it should be the trouble is probably in the gasket, but if this symptom is not present at all it is a reasonable supposition that the gasket is all right, and something else must be examined instead.

BLOW FROM EXHAUST WHEN HANDLE IS PUT TO RUNNING OR RELEASE POSITION.

An excessive blowout of the train-pipe exhaust port on a lone engine or very short train (one or two cars) when the handle is moved to running or release position after applying the brakes, is no cause for alarm unless it be very extreme, as it is simply due to the fact that the train-pipe fills more quickly than the cavity *D* because the ports are larger, and until the pressure on top of the equalizing piston becomes greater than that beneath it, such a blow must be the natural result. This blow will stop more quickly if the handle be thrown immediately to full release position in letting off the brakes than if merely moved to running position as in the former case; the cavity (*D*) then has the benefit of an additional port (*e*) through which it may fill, while the release opening is not as much greater in proportion. If the piston refuses to close the exhaust in a reasonable time it should be taken out and thoroughly cleaned.

New York Engineer's Valve—Plates 15 and 16.

This valve, as well as the two of which we have previously treated, has the three principal positions of the old three-way cock "release" for letting the air from the drum back into the train "application," for shutting off the drum and exhausting the air from the train to the atmosphere, and "lap," which closes all communication either way.

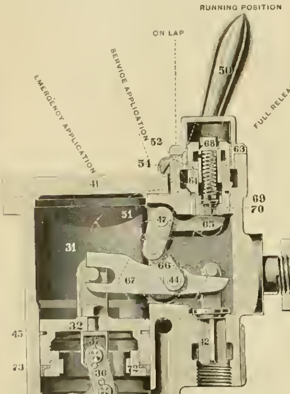


PLATE 15

BLOW FROM EXHAUST.

If there is a blowout of the exhaust when the handle is in the release position, or on "lap," valve 42 is the offending part, and must be examined to ascertain whether it seats properly and if the seat is tight. If the pressure in the train-pipe constantly increases while the handle stands on "lap" the connections controlling communication from the drum to the train must be investigated. These are the piston 32 and the valves 64 and 70. The piston is balanced between drum pressure below and train-pipe pressure above, and if the packing rings are not perfectly tight, the pressure in the train with the handle on the "lap" will soon show again on the gauge when the engine has no cars attached, or in other words, only a short pipe connected. This leakage can be reduced to a minimum by keeping the leather 73 soft and pliable.

RELEASE OF BRAKES.

Releasing of brakes on the lone engine will be apt to be one of the results of any leakage from the drum into the train, and an examination of the engineer's valve should be made before blame is laid on the triple.

In case of failure of the exhaust from the train to open fully when the handle is put to the emergency position, attention should be given immediately to the spring 33, as a weakening, displacement or breaking of this spring would cause such defective action.

Boilers That Do Not Break Stay-Bolts.

"I read a report in LOCOMOTIVE ENGINEERING the other day," remarked Mr. William Buchanan, of the New York Central, "that the master mechanic of some road has large modern locomotive boilers in use that run for years and break no stay bolts. That is a kind of boiler that I would like to see the drawings of. I have been studying the designs of boilers for a great many years, and trying every rational thing suggested, to prevent the breaking of stay-bolts, but I am far from having found a perfect remedy. Good material and forms arranged to provide as far as possible for the varying strains do much to make a boiler safe and durable, but I have never seen a large boiler subject to modern pressures that would run long without having broken stay-bolts. You newspaper men ought to enlighten people by publishing the drawings of the wonderful boilers that break no stay-bolts."

We are looking round for the drawings, and will give them full publicity when we are certain that their stay-bolts do not break. It may be that the conditions of service—the uniform requirements of steam making, good feed-water and light service—may enable the boilers to run on one road without breakage of stay-bolts, while they would be no better than other boilers under more trying circumstances.

The Premium System.

The premium system introduced to induce enginemen to use their best efforts to save coal and oil is doubtless a benefit to the railroad companies; but it is a source of constant heart-burning and jealousy among the men. There is some reason for believing, too, that the apparent saving is greater than it is in reality. Men well informed in the matter say that saving of coal and oil is sometimes effected by practices which increase the cost of maintenance and repairs. It would be a good thing to have all possible information on this subject. We are glad to see that the Traveling Engineers' Association are going to investigate it a little. Among the questions in a circular issued are the following: Have you tried the plan of paying premiums to the engine crew showing the most economy in coal? What is your opinion of the premium system? If premiums are paid, should they be given for greater mileage per ton in the month, or for greater improvement over previous months? Would the last plan encourage the poor or indifferent fireman to try to better his record? If you do not pay premiums, what course do you pursue to encourage your engineers and firemen to save coal? Do you furnish your engineers and firemen with any literature bearing on the subject of combustion of coal in locomotive fireboxes?

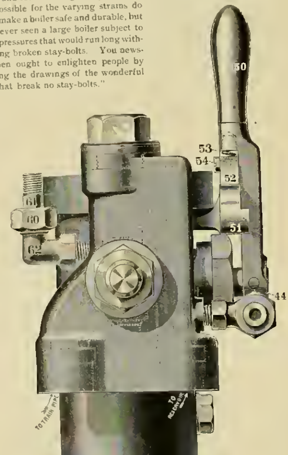


PLATE 16

Foreman J. C. Clarke, of the Woodward Oklahoma shops, of the A., T. & S. F., is rather proud of the record made by one of his engines, a 17 x 24-inch "Blood," with a 56-inch wheel. Two of these engines pull a mixed train between Woodward and Panhandle City, Texas, a distance of 143 miles, but one of them broke down in December, and the other one doubled, making in January 6,908 miles, pulling on an average six loads, a combination car, and a coach. This month's work was done on running repairs costing only $16.20, and without the boiler being washed out—something unusual, as chain-gang engines only run with that water 2,000 miles between washings. This road allows a pint of valve oil for 75 miles run, and a pint of engine oil for 45 miles, yet the men on this engine ran 86 miles to the pint of valve, and 60 miles to the pint of engine oil. Mr. Clarke gives all the credit of good work to the two engineers, John Scott and J. M. Bushwell, who took pains to blow the boiler out and otherwise interested themselves in keeping the old girl on her legs.

The Compartment Car Defended.

The numerous visitors from England who traveled on our trains last year appear to have gone home and told that traveling by rail in America is more comfortable than it is in the British Isles, and that our passenger cars are stronger and safer than the small compartment car used in England. This, coupled with object lessons of English cars going to pieces in wrecks, has stirred up an agitation in favor of changing English passenger carriages to the American model. A correspondent signing himself "Carriage Builder" has written to *Engineering* defending the English cars, and finding fault with those used on this side of the Atlantic. The correspondent evidently has never been in an American train, since he asserts that our car "rolls heavily," but he will no doubt convince many people that his views are worthy of consideration although they are the mere vaporing of ignorance. The letter reads:

"So much is heard in England regarding the superiority of the American railway carriages, and at the same time one reads of so many serious accidents (so numerous that in October one American paper had a column headed 'The Daily Smash'), that some remarks comparing the two types of carriages may not be without interest.

"The main difference is that the English carriage is on the 'compartment' system, one vehicle containing say six distinct compartments, not communicating one with the other. In the States the vehicle is on the 'corridor' system, and is practically one large open room with a passage down the center, each carriage communicating with its neighbor. The American vehicle, which is invariably longer than the English, is entered by a door at either end, instead of one door on each side for each compartment.

"The American condemns the English compartment because the passenger is at the mercy of any rogue or madman who may be his or her sole companion, and is, therefore, occasionally the victim of serious assault without being able to obtain assistance or move to another part of the train. Undoubtedly their system has the advantage over the English in that respect.

"They obtain the corridor by making their carriages some twenty inches wider than the English, and at the same time they gain head room by raising the height of the vehicle in the center. The rail gauge being the same in each case, it will be at once seen that in America the center of gravity is placed much higher, consequently the carriage is more liable to oscillation, and, in fact, it rolls heavily, especially when striking points or entering a curve, when the tendency of this large and somewhat topheavy vehicle (in some modern cases seventy-six feet long and weighing nearly fifty tons) is to shoot forward at a tangent to the rails. It is, therefore, more than probable that many derailments are caused, and the serious consequences of accident intensified by the disposition of this vehicle to leave the rails and fall over on its side.

"This wide vehicle is attached to the two bogies in the usual manner by resting on three blocks, and being held down by one bolt in each bogie, the strain upon these two bolts must at times be so enormous as to break them, when, of course, the carriage is free from control.

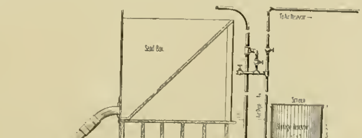
"Another feature of American coaches open to adverse criticism is the form of the seat, and the manner of attaching it to the vehicle. In England the seat is an integral part of the carriage, and, even in the third-class, is padded high enough to form a rest for the head. Across the water the seat is little more than a chair attached by screws to the floor of the carriage, and the back of the seat, which is reversible, only reaches to the shoulder, as shown by the diagrams. In the event of a sudden stoppage or jerk the American either falls forward with his face or chest against the back of the seat in front of him, or, having no support to his head, his neck is probably broken over the back of the seat he occupies. Take a very serious shock, say a collision or derailment, the seats in all probability give way, and, with the passengers (perhaps fifty in number), are thrown together in a confused heap at one end of the car, where in winter the lighted stove adds to the horror of the situation. In England the compartments localize the personal injuries.

"As a matter of comfort in traveling, the third-class passenger here is even better off than the first-class passenger in America, in each case setting aside the more wealthy passenger who travels in parlor cars or saloons, whilst the English vehicle offers considerable advantages, as already shown, in the direction of safety of the passengers generally."

Bad Explosion of a Locomotive Boiler at the Erie Shops, Jersey City in 1864. From an Old Photograph in the Possession of W. L. Bo[illegible]

Pneumatic Sand Hoist.

The annexed engraving shows very plainly the arrangement of a pneumatic hoist for sand, in use at the West Chicago shops of the Chicago & Northwestern.



Pneumatic Sand Elevator.

Mr. William Smith, superintendent of motive power, writing to us about the hoist, says: "It is placed in the sand shed and this shed is dug out and walled up at the end of our coal shed. The building is about as high as the coal shed, and we run the sand cars up into it, the same as we do the coal in coal shed, and dump the sand from the cars into the sand shed underneath.

"We have two sand reservoirs down on the floor of the house, one of which is buried level with the floor, while the other stands above the floor. The upper one is what we term the storage reservoir, and is about the size of an air-drum, as is also the under one. When the sand is dried it is thrown into the storage reservoir, and we keep this reservoir full; we have a screen in the top of this storage reservoir which allows nothing to pass that would obstruct the working of the sand-valves and pipes. When the lower reservoir is empty, we open the connecting cock between the two reservoirs and allow the sand to run into the lower one by the force of gravity until it is full. We then turn the air on just below where the pipe is cut, which throws the sand up into the sand bin. In filling the sand bin care should be taken not to quite empty the pipe of sand, for by so doing it is pretty hard to start it again. The cock on the loose end of the pipe is intended to be opened immediately the air supply is shut off, thus leaving a supply of sand in the pipe. By so doing the sand starts immediately when the air is turned on, whereas, if the sand is allowed to entirely run out of the pipe it will have to be primed before it will start. The device so far, has worked very well with us."

They have commenced running dining-cars on some of the English railways, a peculiarity of the service being that there is a first-class and a third-class dining-car, with a kitchen-car between them. The trains having this greatly needed accommodation are vestibuled, and the passengers can pass through the train, a thing not practicable with the ordinary compartment car so much used. The vestibules are different from those used in America, being made of galvanized sheet-iron to form the gangways with "bellows" made of rubber sheeting. A novelty in connection with these dining-cars is that they are reported to pay the companies running them. We would suggest that some of the American railway companies which are constantly complaining about the loss incurred in running dining-cars try a third-class attachment to feed the people of small means, who form the vast majority of travelers.

In September last the trainmen on the Nashville, Chattanooga & St. Louis accepted a reduction of pay of 10 per cent. and made no serious objection. President Thomas of the company has now displayed the way that he appreciates this helpful spirit by announcing that he is about to abrogate an agreement made with the men two years ago. If ever there was a railroad manager who deserves to have a fight on his hands it is General Thomas. He never was on any other railroad and has no idea of how white men ought to be treated.

Mr. V. B. Lang has resigned the position of general foreman of the West Shore railroad shops at New Durham, N. Y., and accepted the position of master mechanic of the Louisville Southern road at Louisville, Ky.

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Notice to Correspondents.

Owing to the great number of letters received, answering air-brake puzzles, that are practically the same, many do not appear.

Let us suggest a few points for writers on this line. Don't ask solutions of puzzles, the answers string out over several months. State the trouble briefly and plainly, and then the remedy you applied and the process of finding out the trouble. This is better than the puzzle, and thoughtful air-brake men will study the symptoms just as thoroughly, and those not so thoughtful will learn something—a month after they will have forgotten the case.

Don't send a letter without signature and address—it won't be published. Don't mix up a letter for publication with something else, and please don't use up half your paper telling us what a good paper LOCOMOTIVE ENGINEERING is,—we know it is the best and that you appreciate it, but it takes time and shocks us to have to blue-pencil out so many kind words. The readers want plain, tersely-stated, interesting facts. These are the kind of letters we love to get.

SINCLAIR & HILL.

Judge or Dictator?

It appears nowadays to be the fashion when a railroad company does anything which is likely to lead to a strike among the employés, for some influential person connected with the company to obtain an injunction from a judge of the United States Court, forbidding the aggrieved employés from striking. The most recent case of this kind was that of Judge Dundy, who issued an injunction restraining the employés of the Union Pacific from striking against a reduction of pay. The following paragraph gives the most important part of the order.

"Any employé who does not wish to continue his employment under these conditions (reduced pay) may terminate it at any time and in any manner he sees fit, so as not to obstruct business; and it is unlawful for any employés to conspire, combine or confederate together while in the service of the receivers, or with, by or through any labor or other organization, or the officers or committees thereof, or with other person or persons whosoever, for the purpose or with the intention of inducing a strike upon any of the railroad or teleghraph lines operated by the said receivers under the direction of this Court, or to do any other thing, either individually or collectively for the purpose of hindering, impeding, [illegible]ing, obstructing, embarrassing [illegible]g the receivers, in and about t[illegible]f the business."

We believe that in all cases of this character, a much much serious principle is involved than that of putting in the hands of receivers or railroad managers the power to coerce their men into accepting reduced wages. The violation of a principle of liberty of action is involved, which ought to appeal directly to every man who prides himself on living in a country where individual freedom is the heritage of all. If it is illegal for railroad men to combine for self-protection, when the property they are working for is in the hands of a receiver, common sense would say that it was illegal for them to "combine or confederate" under any circumstances. If the order of Judge Dundy is based on the laws of the United States, then the laws of this country are more unjust towards labor than the laws of any other country where large numbers of men are engaged in industrial pursuits. We understand that the laws of Mexico and of the South American States give the employer power to deal very summarily with "confederated" employés, but there is not a country in Europe where the order of Judge Dundy would not be considered an indefensible outrage on the liberties of the workman.

An unjust United States judge may exert acts of tyranny exceeding the powers reposed in any other personage belonging to a country with a constitutional government, but, we believe that in his order to the Union Pacific employés, Judge Dundy exceeded his legal authority. His order followed the spirit of an injunction issued by Judge Jenkins to the employés of the Northern Pacific. We understand that those who obtained the injunction from Judge Jenkins regarded it as a bluff, and that they were very much afraid that the men would strike, and fall back upon the courts to decide whether or not a United States judge had authority to prevent them from combining for self-protection. We consider a strike of railroad men an unmitigated evil for the unfortunates who take part in it, but an order of a court restraining men from combining together so that they may be able to act as a unit, is striking at human liberty in a style which is foreign to the letter and spirit of our system of government. A strike is a misfortune, but any man who has any sense of fairness and justice, ought to rejoice in seeing some case arise where there would be an opportunity of finding out whether a United States judge is a dictator or an administrator of the laws of the country. A strike is an evil in the same sense that war and rebellions are evils, but cases sometimes arise where no other means are practicable in resisting tyranny. If the existing laws of the country make a man a criminal for combining to protect his own interests, the sooner a distinct understanding is reached the better for all concerned.

Reproof for an Unjust Judge.

There are indications that the United States Circuit Judges, who have been a law unto themselves in making decisions against labor organizations, are about to be made to understand that they are the servants of the law and not dictators. A resolution has been introduced in the House of Representatives calling for the impeachment of Judge Jenkins for his action in intimidating the employés of the Northern Pacific. This may not come to anything, but it intimates to Judge Jenkins and others holding similar sentiments that their masters, the people, are watching them.

Facts have lately been made public showing that the position taken by Judge Jenkins was disputed by one of his associates. When he issued his order restraining the Northern Pacific employés from striking, it was sent to Judge Caldwell, asking for a similar order for the territory covering his jurisdiction. Judge Caldwell declined to do this, and publicly stated his position in regard to the matter in the following emphatic language.

"If the receivers should apply for leave to reduce the present scale of wages, before acting on their petition I would require them to give notice of the application to the officers or representatives of the several labor organizations to be affected by the proposed change, of the time and place of hearing, and would also require them to grant such officers or representatives leave of absence and furnish them transportation to the place of hearing and subsistence while in attendance, and I would hear both sides in person, or by attorneys, if they wanted attorneys to appear for them. The employés on a road in the hands of a receiver are the employés of the court, and as much in its service as the receivers themselves, and as much entitled to be heard upon any proposed order of the court which would affect the whole body of employés.

"If, after a full hearing and consideration, I found that it was necessary, equitable and just to reduce the scale of wages, I would give the employés ample time to determine whether they would accept or reject the new scale. If they rejected it they would not be enjoined from quitting the service of the court, either singly or in a body. In other words I would not enjoin them from striking, but if they made their election to strike I would make it plain to them that they must not, after quitting the service of the court, interfere with the property or the operation of the road or the men employed to take their places. A United States Court can very readily find the means to effectually protect the property in its possession and the persons in its employ. I have in one or two instances pursued the policy I have indicated, and the differences were satisfactorily adjusted."

Subsequently, when a strike seemed about to occur on the road against a reduction of 10 per cent in wages, Judge Jenkins issued a second order of injunction against the proposed strike. When this order reached Judge Caldwell he ran his pen through that part arbitrarily enjoining the strike, leaving it only as a general restraining order against interference by violence or otherwise with the peaceful operation of the road by the successors of the strikers. This was not what the attorneys for the road wanted, and it was never recorded.

Improving the Valve-Motion of Locomotives.

Within the month we have received drawings of two forms of valve-motion designed to take the place of the link in operating locomotive valves. One is a modification and complication of a Corliss valve-gear, the other is designed to operate a rotary valve of the stove-damper pattern by means of a vertical shaft secured to the cylinder, receiving motion from a shaft extending to the main crank-pin and engaging in a miter-gear attached to the pin. Both of the valve-motions in question display signs of great ingenuity and careful designing, but we do not believe that either of them will ever operate the valves of a locomotive pulling a fast train.

The ambition to design and introduce into service a valve-motion which shall eliminate the reputed defects of the link-motion is still keeping inventors at work, but we have no expectation that they will ever accomplish any improvement on the present gear used for the distribution of steam in locomotives. There is good reason for believing that all the labor, all the ingenuity, and all the money expended in trying to invent substitutes for the link-motion is so much misdirected effort. The modern type of locomotive has been in use about sixty-five years, and it is doubtful if a year has passed in that period when some highly promising improvement was not offered to produce a better distribution of steam. For a few years before the link-motion was brought into use there were more inventions of valve-motion patented than of any other device. The link-motion was tried, and was considered of so little prospective value that it was not patented, yet within a very few years it monopolized the entire field, not only for locomotives, but for marine and every form of reversing-engine. As a reversing-gear it has unquestionably no equal, as a gear for distributing steam under constantly varying conditions of load, it has a better record for economy than anything else that the engineering world is familiar with.

What are popularly regarded as the faults of the link motion are readily perceived when engineers begin to study valve motion. More experience, however, very often convinces the same men that what they first considered to be grevious faults are really admirable merits in this type of valve gear. The student who looks at the motion with a critical eye becomes disgusted with the action of the motion when cutting off early, especially if he studies the subject by the aid of indicator cards. He starts out with the theory that steam ought to be admitted to the cylinders promptly enough to make the initial pressure close to that of the boiler. The supply of steam ought to be maintained to make a horizontal steam line up to the point of cut off, after which expansion should describe a hyperbolic curve, and then escape like an explosion at the end of the stroke. On the return stroke there should be no back pressure worth mentioning, and the valve should remain open long enough so that the compression which follows closure will be just sufficient to cushion the shock of the reciprocating parts. This is the ideal. The link motion has little of the theoretical ideal, but for making good use of the coal consumed it distributes the steam of a locomotive better than any of the perfected motions ever tried.

Among the numerous locomotive-valve gears tried as substitutes for the link, several have produced diagrams that closely resembled the well-known Corliss card. They have made cards from which an important economy of steam could be figured over the cards of locomotives with link motion doing similar work; but it was invariably found that the engine making the approach to the ideal card burned more fuel than the engine with the link motion, which made a card that looked like a leg of mutton. We do not believe that anyone ever gave the subject of valve motion more profound and intelligent study than the late William Wilson, superintendent of machinery of the Chicago & Alton; and we think he obtained a more thorough grasp of the subject than any other man we have ever met. He was ambitious to put on a locomotive a valve-gear that would make a Corliss card, and he succeeded. That is, he got the engine to make a close approach to a Corliss engine card when the piston speed was less than 600 feet per minute; and what might be regarded as a greatly improved card up to the highest speeds necessary for express trains. But to the intense disgust and disappointment of the inventor, the locomotives having the improved valve-gear used more fuel than the engines with the link motion.

Others who have attempted to improve the link motion or the valve dimensions to approach as near as practicable to good stationary engine practice, have been disappointed with the results. An effort at improvement frequently tried has been providing very large ports and steam passages, and giving unusually long valve travel. We have never known a locomotive with abnormally large ports and long valve travel that was not wasteful in the use of fuel. It is a little difficult to theorize on the true cause of this. What ought to be a means of saving fuel turns out in practice to be a source of loss. The evidence of this being the case is so overwhelming that we are compelled to admit that it is true. From the standpoint of a designer of high class stationary engines, the European locomotives, with their short steam ports and short valve travel, ought to be less efficient than American locomotives in using steam; but American locomotives do not compare in economy of fuel with those used abroad.

There are two causes which may account for the inferior economy of the locomotive built to approach the automatic engine ideal. Those who have attempted to dispense as far as possible with cylinder compression aggravate the losses that are due to cylinder condensation. All engines using steam with a wide range of temperature between the initial and the exhaust suffer more or less from the cooling of the cylinder to the temperature of the exhaust steam. When the hot steam enters from the boiler a portion of it is used in heating up the cylinder. Engines with their cylinders so badly exposed to the cold atmosphere as locomotives, are very susceptible to the losses from condensation. When sufficient steam is left in the cylinder to be compressed to near boiler pressure at the beginning of the stroke, the mechanical heat generated by compression passes partly to the cylinder and reduces the loss from condensation. Within proper limits the compressed steam also saves live steam, since it fills the clearance spaces close to boiler pressure. The attemps which Wilson and others made to run locomotives at high speed with the least possible compression involved the need of increased lead, so that live steam would fill the clearances and prevent shocks at the end of the stroke. It is easy to see how this would put a greater drain on the boiler than that required by the engine that was utilizing the blow of the reciprocating parts to compress steam to fill the passages and heat the cylinders.

Engines with very large ports have, necessarily, more clearance than those with small ports. The filling of the large ports may readily cause loss of steam unless the necessary compression is obtained. When the valve travel is long the compression is likely to be restricted. The combination of long ports and long travel may, therefore, tend to waste steam by drawing upon the boiler for steam to fill the clearances. The quick opening of the valve may cause such a rush of steam from the boiler that there is a constant tendency to entrain water with the steam, which has a most pernicious effect on economical working. Again, the quick opening of the valve for release may intensify the exhaust action on the fire, causing quick, sharp exhausts instead of what approaches a continuous flow of steam through the nozzle.

These are merely theories. It seems certain, however, that large ports and long valve travel make an engine expensive in the consumption of fuel. There must be rational causes for this, and those we have offered give the only explanation we can think of after devoting careful study to the subject.

Piece-Work in Shops.

There is considerable prejudice among many skilled mechanics against the practice of piece-work in shops, which, we believe, to be based on a misconception of the true interests of the workman. The individual mechanics ought all to be favorable to any practice which tends to make first class workmen, and to fully remunerate every man for the work performed. When payment is made on the basis of the amount of work finished, it has a stimulating effect to induce the young mechanic to make himself a first-class workman. Nearly all mechanics will prefer to do a fair day's work without pressure from foremen or gang bosses, but there are in every shop men who are mentally and physically opposed to doing more work than they can help. They will put themselves to greater exertion in working out schemes to cover their idle habits than would be necessary to do a fair day's work if their efforts were rightly directed. This class of man is violently opposed to piece-work, and being positive and aggressive he carries others into supporting his views, whose real interests are all on the side of piece-work, since on that system they are not called upon to do the work of the loafer. Efficient superintendents and foremen have a pretty accurate idea of how much work ought to be turned out of a shop every week in proportion to the number of men employed. If there are many idlers in a shop who habitually avoid doing their own share of the work the industrious men have to work harder to keep up the average. Every man who has worked in a shop is familiar with the trifler who is always saying something and devoting his whole attention to talk when the foreman is not in sight. We all know the man who makes believe that he is constantly busy and accomplishes nothing. Then there is the other type, who frequents hiding places and grins at the other fellows doing the work. The industrious workman is in the majority, and he ought not to be called upon to perform the labor these idlers are paid for doing. In piece-work every man gets credit for his own performance.

Employers have been greatly to blame for the unpopularity of piece-work among mechanics. When, by industry or developed skill, workmen in any department began making good wages under the piece-work system they have been cut down in prices until they could make little more than that received under day wages. This is not only an unjust but a stupid policy on the part of the employers, for they become the losers in the end. The first effect is to cause the best class of workmen to quit, and their places are taken by inferior men who are always accustomed to low pay. The next effect is to make the men careful not to do much more by piece-work than they would finish by the day. Men are sensible enough to understand the policy of the employers, and where they are likely to be fairly treated when they show how much work they can do. Another objection from the employers' point of view to the cutting down practice is that it arouses the antipathy of the workmen, and they strive to get bad work passed. It is difficult for any method of inspection to detect bad work when the workman feels that he is justified in retaliating upon his employer.

The system of piece-work, as it is carried on in many shops, greatly increases the productive capacity of tools and shop space and enables workmen to make exceptionally good pay without very hard work or long hours. There is no place for the idler in establishments of this character, and there are seldom openings for new men, because those employed know a good job when they find it and stick to it. Men working in these places, where employers take an equitable view of payment for piece-work, could not be driven back to the day-work system. That the piece-work system does not work well in some places is due almost entirely to the grasping tendencies of the employers. They rob the system of its chief merits, and then declaim against workmen for being opposed to an arrangement which calls for pay according to the work performed.

Does Sycophancy Help an Operator to Promotion?

A list of nearly 200 railroad officers, who have risen from the position of telegraph operator, has been published by the *Railway Age*. The *Age* finds a moral in the career of these men, which is: "Do not agitate for increase of pay, and you are likely to get it." Our contemporary puts the unction to its soul and rubs it in, that none of the men who have risen to eminence from the operator's key was ever guilty of agitating for increase of pay. That is just where the *Age* is wrong. The energy which forces a man upward is likely to make him take an interest in the condition of himself and fellow-men at the time he is at the bottom of the ladder, and cowardly fear of consequences is not likely to make his tongue mute. We know that some of the men who have risen highest from the operator's key were in former times the most energetic in advocating the interests of their class, and that they still retain warm sympathy for the struggles for better remuneration of the men who remain in the lower ranks. It is a slander on the able men who have pushed their way upward, to say that their way was made easy by their turning their eyes up in holy horror at others who had the courage to say that they were miserably paid. Operators are the worst-paid class of skilled workers in the railroad service, and the men who have come from that position fully recognize the fact.

The Uriah Heep who is always "'umble" is sometimes found in the position of telegraph operator, but the robust atmosphere of the United States does not agree with him. His progress is generally downward. The man who has the courage to stand by the interests of his class does not suffer in his upward aspirations. The real test of his fitness for promotion is ability to perform the duties of a higher position satisfactorily. If he exhibits the qualifications required, his sympathy with or against his fellow-workers will exert very little influence.

Merciful Treatment Pays.

The policy of running a railroad in the manner described by Mr. G. R. Brown in his article on "Discipline without Punishment" in the last issue of LOCOMOTIVE ENGINEERING ought to appeal to the self-interest of railroad stockholders, for some figures based upon historical data indicate that the Fall Brook Railroad, of which Mr. Brown is superintendent, has enjoyed extraordinary immunity from serious accidents. The following facts may be accepted as correct:

"During thirty years not one passenger had been killed, and only six have been injured, two of those by fault entirely their own, the total number of passengers carried having been over six millions. The record for 1893 is in keeping with previous years: 461,000 passengers having been carried, and only one injured; that one forgot to leave the train when at his station, and was slightly injured in his attempt to get off the train after it had again started. As to casualties to employés engaged in the handling of cars and trains, one employé was killed and forty-three were injured during 1893, the number of trains handled being 27,843, running 2,058,064 miles, these trains being made up of 597,825 cars, running 42,267,931 miles."

The numerous railroad men who have been interested in the experimental work done in the laboratory of the Purdue University, will regret to learn that the engineering laboratory has been burned down. A feature of this laboratory, which was of special interest to the engineering world, was an apparatus on which a locomotive could be run under conditions similar to those met with in service. They had a Schenectady locomotive which was experimented with a great deal, and much valuable information was obtained. They were about to begin a new series of tests when the building was burned, and the engine with much other engineering appliances destroyed. It was in connection with this institution that the Railway Master Mechanics' Association voted to expend a large sum of money in carrying out tests. The proprietors of the University have determined to rebuild the laboratory, and equip it with even more elaborate apparatus than that destroyed. Professor Goss is the leading spirit in the work to be done, and he is actively at work making preparations for the equipment of the new building.

PERSONAL.

Mr. E. B. Gilbert has been appointed master mechanic of the Pittsburgh, Shenango & Lake Erie in place of Mr. E. Richardson, deceased.

Mr. J. D. Morehead has been promoted from round-house foreman of the Vandalia line, at Terre Haute, to be master mechanic at Paris, Ill., of the same road.

Mr. C. C. Richardson has been appointed chief clerk of the locomotive and car department of the Pittsburgh, Shenango & Lake Erie under Mr. E. B. Gilbert, master mechanic.

Mr. E. P. Mallinson has been appointed master mechanic of the Brooklyn Elevated Railroad, with headquarters at Brooklyn, N. Y. Mr. Mallinson was formerly in the Navy Department, and is a graduate of an engineering school.

Mr. E. J. Jardin has been appointed general inspector of rolling stock of the Brooklyn Elevated Railroad. Mr. Jardin is a locomotive engineer of long experience, and was for several years on the Long Island Railroad.

Mr. Ben. McKeen, Jr., son of President McKeen, has been promoted to be superintendent of the Peoria division of the Vandalia line, with headquarters at Terre Haute, Ind. A correspondent mentioning this appointment says: "Ben is a perfect little gentleman, and is well liked by everybody connected with the road."

A rumor has been lately current in New England that Mr. T. A. Mackinnon, general manager of the Concord & Montreal, has been appointed general manager of the Boston & Maine. There is some doubt about the news of the appointment being correct, but it seems certain that Mr. Mackinnon was offered the position if he cared to accept it.

One of our correspondents, Mr. J. M. Keith, who is master mechanic of the Western Railway of Guatemala, mentions a curious plan which he adopted to find the extent of back pressure in the cylinders of a locomotive. He drilled a hole in the base of the exhaust pipe and put in a ¼-inch connection with the air-drum. The air-gauge then indicated the back pressure in the cylinders.

The Traveling Engineers' Association appears determined to go very thoroughly into the investigations they undertake, if we are to judge by a circular calling for information lately received from Secretary Thompson. The committee is composed of M. Mast, chairman; W. E. Chapman, J. W. Sheldon, Geo. H. Brown and P. A. Rossiter. Their circular contains forty questions, all of a highly practical character.

A circular of inquiry concerning the use of sundry devices has been issued by Mr. O. Stewart, chairman of the committee of the Master Mechanics' Association having that subject in charge. The aim of the circular is to find out what improved appliances are in use to apply sand to the rails for the purpose of preventing locomotives from slipping, and how efficient they are as compared with the common sandbox.

Mr. M. J. Redding, who for the past year has held the position of night general foreman for the St. L. I. M. & S. Ry., at Baring Cross, Ark., has been tendered the position of master mechanic of the White & Black River Ry., with headquarters at Brinkley, Ark. Mr. Redding had been connected with the Missouri Pacific system for several years, in charge of the air-brake department, and none knew the business better than he.

Mr. W. Lavery, master mechanic of the Erie at Susquehanna, Pa., has been appointed assistant superintendent of motive power, with headquarters at Cleveland, O., succeeding Mr. Higgins, resigned. Mr. Lavery has been a long time on the Erie system, and has been noted for his success as a shop manager. There have been few men in the country who have approached him in the systematic manner in which he has conducted machine shops.

Mr C Youmans has been appointed general foreman of the New York Central shops at Depew, N Y Mr. Youmans was formerly with the R. W & O. Railway, at Oswego, N Y

Mr William E Tew has been promoted from the position of assistant superintendent of the St Cloud division of the Great Northern to be superintendent of the Cascade division or the same road, with headquarters at Leavenworth, Wash

Mr W D. Stansifer has been appointed storekeeper and purchasing agent of the Butte Anaconda & Pacific. with headquarters at Anaconda, Mont. Mr. Stansifer has been for years connected with the supply department of the Great Northern

Mr C B Wilburn has been appointed superintendent and traffic manager of the Chattanooga, Rome & Columbus, with headquarters at Rome, Ga. Mr. Wilburn was formerly general freight and passenger agent of the Savannah, Americus & Montgomery

Mr. Henry C. Ayer, intimates that he has severed his connection with the firm of Pedrick & Ayer, and with that of H. B. Underwood & Co He has associated himself with Mr. Gleason, and under the name of Henry C Ayer & Gleason Co., has commenced the manufacture of machine tools and engines.

Mr. V B. Lang has been appointed master mechanic of the Louisville Southern, with headquarters at Youngstown, Ky. Mr. Lang was formerly general foreman of the West Shore shops at New Durham, N J. While in that position, Mr. Lang was noted for the neat appearance of his shops, and for the systematic manner in which the work was done.

Mr S A Sheppard, who has been for some time master mechanic of the Tavares & Gulf Railroad, has been appointed master mechanic of the Carrabelle, Tallahassee & Georgia Railroad, with headquarters at Carrabelle, Fla. Mr Sheppard is a warm friend of LOCOMOTIVE ENGINEERING, and encourages men under him to profit by its educational facilities

Mr H. Dabbs, a very promising young mechanic, who has been working in the shops of the St L. I. M. & S Ry, at Burring Cross, Ark, has been appointed general night foreman, succeeding Mr Redding. Mr. Dabbs had formerly held a similar position in these shops, and was for several years connected with the Thomas Manufacturing Co., at Little Rock, Ark, in the position of foreman.

We have heard the remark made that the business of making aluminum horseshoes, which Mr. C C Jerome, the metallic packing maker, has entered upon, would not appear to amalgamate naturally with the manufacture of metallic packing In answer we would say that the two lines of manufacture are kept entirely separate—they have no connection with each other, except in having the same head, which is inventive enough and energetic enough to manage two shops

Mr S Higgins has been appointed superintendent of motive power of the Lehigh Valley Mr. Higgins has been for several years assistant superintendent of motive power of the Erie system, with headquarters at Cleveland, O He rose through various steps to that position. He is a remarkably bright mechanical engineer, and has contributed valuable papers to the different railroad clubs, and done valuable committee work for the Master Mechanics' Association, of which he is an active member.

A new firm, Henry C. Ayer & Gleason Co., has been formed in Philadelphia for the manufacture of railroad specialties. Mr. Ayer's name is familiar to railroad men through his partnership in the firm of Pedrick & Ayer. They have started works at 2d and Diamond streets, where they are manufacturing machine tools, twisting machines and the leading appliances required in railroad shops An equipment of first-class tools has been put into the works, and the intention is to make all the products of excellent finish and quality

John J. McGrane, the well-known railroad jeweler of this city, made a neat stroke of business in getting complete control of the sale of the U. S. Waltham Co.'s new fine watch, named "The President" This movement is the latest, and has every known improvement up to date. It has been thoroughly tested, and the makers offer with it a written guarantee for its time-keeping qualities It takes some nerve to guarantee the sale of a large number of fine movements per month to hold a monopoly on a brand of goods, but John has sand and knows the watch will bear out all that can be said for it.

An effort has lately been made to turn out Captain Tyler from the management of the Atlanta & West Point R. R., with small prospects of moving him. Captain Tyler is a railroad man who began work at the first round of the ladder, and rose by native energy to his present position. He rose through the mechanical department, and was once noted as a first-class engineer, and first-class has been his characteristic in every position held since he began railroading He is exceedingly popular with high and low, and by his superior management operates the road under his charge at the lowest possible cost Those interested in the Atlanta & West Point property will be fortunate if Captain Tyler is retained in charge

Mr Isaac D. Barton has been appointed general superintendent of the Brooklyn Elevated Railroad, with headquarters at Brooklyn, N. Y. It is understood that Mr. Barton represents the Corbin interests in the Brooklyn Elevated road, having been long associated with Mr Corbin on the Long Island Railroad. For the last two years he has been general superintendent of the New York & New England, and is considered one of the most efficient operative railroad officers in the country. He has had quite a varied career in railroad service, having been station agent, conductor, train master, superintendent and general superintendent He was for some time superintendent of the United States Rolling Stock Co., and had considerable experience in railroading in the West.

The Southern & Southwestern Railway Club, which is a particularly active organization, of which Mr P. Leeds, of the Louisville & Nashville, is president, will have their next meeting in April at Atlanta, Ga. The bill of fare is sufficient to attract railroad men from distant States Mr. E M. Roberts will present a report on "Construction of Ends of Box Cars," with special investigation into remedies for the bulging of car ends "Is the Collar or Collarless Axle the Best Adapted to General Rolling Stock?" will be introduced for discussion by Mr P H Shreiber Mr McGee will present for discussion ideas on "The Relative Strength of Different Patterns of Metallic and Composite and Wooden Brake-beams under Service Strains." Mr Philip Wallis will report on "Soft Plugs for Crown-sheets of Fireboxes, Best Form and How to Keep them Effective" Mr W H Thomas will report on "Best Method of Keeping Locomotive Tubes Clean," and a variety of other interesting subjects will be brought up for discussion.

There has been a great deal of newspaper talk about contemplated changes on the Vanderbilt system of railroads. The Buffalo newspaper offices seem to take the lead in the manufacture of rumors of this kind. They had it definitely settled that Vice-President Clark, of the New York Central, was about to retire, and that Mr. Webb would take his place. We confess that it would be in the interest of good business if this change took place, but there seems to have been no foundation for this rumor. Various other minor changes were indicated for the New York Central, all of them originating in the fertile brain of the newspaper paragrapher The Lake Shore was also the subject of contemplated changes, among them being the rumor that Mr. Canniff, general superintendent, was about to retire. President Newall, talking about this latter rumor, denounced it very emphatically. He said that "these newspaper fellows are always telling that I am such a damned crank that I can get along with nobody. But even newspapers must acknowledge that there is an exception to all rules, and the exception with me is that Canniff is one of the men whom I can get along with first rate."

The death of Mr Gavin Campbell, whose last railroad position was that of general superintendent of the Wisconsin Central, takes away one of the most interesting personages in the railroad world among those who rose through the mechanical department Mr. Campbell was a native of Glasgow, Scotland, and had considerable experience in marine engineering before he came to this country. Although while quite young he had made his mark as a marine engineer likely to rise to a good position in his own country, he was so impressed with the belief that America was the promised land for a man having to make his own way, that he gave up fair prospects, and came to America to begin at the bottom of the ladder. He began work on the Michigan Southern, and in a few years was promoted to the position of machine shop foreman. In 1871 he was appointed master mechanic of the Wisconsin Central, and seven years afterwards was promoted to be division superintendent In 1885 the directors of the Green Bay, Winona & St. Paul were looking for a man who could run their property economically, and they selected Mr. Campbell to be general manager, a position which he held with great credit for four years. He left that to be general superintendent of the Wisconsin Central, a position which he held until nearly the close of his life.

Hall Signals for the Lackawanna.

The principal operative officers of the Delaware, Lackawanna & Western were ordered by President Sloan to make a thorough investigation of the merits of the various block signaling systems in use and to report The result of the report submitted is an order to the Hall Signal Company, New York, to begin equipping the road with their most improved system. The contract calls for the immediate installation of signals for the M & E division between Hoboken and Morristown, a distance of twenty-nine miles, and for the Montclair branch, which is five miles long. When this work is done the signal system will be extended in sections until the whole line is protected

The signal system chosen is known as the Hall rail circuit, and is the highest development of the automatic electrical signals which the Hall people have been perfecting, step by step, for many years By this system the Illinois Central tracks were protected that carried the immense passenger traffic to and from the World's Fair last year The signals were found not only perfect in protecting trains, but enabled them to be moved with practically no delay The system is also in use on the Jersey Central and other roads.

The Hall automatic block system of signaling requires no personal attention in the setting and releasing of the signals. It is all done by ingeniously arranged electrical appliances, which are actuated by the wheels of approaching and passing trains The signals in the latest system which will be put on the Delaware, Lackawanna & Western stand normally at danger, and are released by the approaching train if the block is clear. The mechanism for releasing the signal will not operate if anything is wrong or should the track be obstructed, a rail broken or a switch open. This arrangement of signals is one which not only secures absolute protection to trains, but is capable of controlling the heaviest species of train service without causing delay Another attractive feature about it is that the indications of the track being clear are given under the eye of the engineer. As the train approaches a block the engineer sees the signal change from danger to clear. That intimates that not only the block is clear, but that there is an unobstructed track 1,000 feet beyond the succeeding signal, that margin being provided to protect a train for a reasonable distance beyond the signal. The apparatus for operating the signals appears to be perfect. Any breakage of mechanism or failure of the electric circuit merely resulting in keeping the signals at danger.

Government Order for Lathes.

The Pond Machine Tool Company, of Plainfield, N. J, for whom Manning, Maxwell & Moore, 111-113 Liberty street, New York, are the sole sales agents, have just been awarded the contract by the Ordnance Department of the United States Army for the manufacture of gun lathes and other machine tools required in the construction of steel breech-loading rifle cannon of 12-inch to 16-inch calibre The other bidders for this contract were the Niles Tool Works, of Hamilton, Ohio Bement, Miles & Co., of Philadelphia, Pa Robert Poole & Son Co., of Baltimore, Md and the Builders' Iron Foundry, of Providence, R. I.

The order consists of three lathes for turning and boring guns, one lathe for turning and finishing these guns, one machine for threading and slotting the guns and the rifling machine. This company have previously furnished to the Ordnance Department twenty-three large gun lathes and two rifling machines for the manufacture of breech-loading rifled cannon of 8-inch and 12-inch caliber. The lathes for 16-inch guns are very much larger and heavier in every particular, as the finished weight of three of these lathes will be 460,000 pounds each.

In the previous large contract awarded the Pond Machine Tool Company, the time for completing the contract was four years, and they finished the contract to the satisfaction of the Ordnance Department, all the lathes having been fully tested and accepted nearly two years ahead of the time allowed them to complete the work, and there is no doubt that the satisfaction given by the execution of their previous contracts, both in regard to the quality of the work and time of delivery, favored them in the decision of the award of the present contract The lathes are to be built from designs by the Ordnance Department, and all the detailed drawings and patterns will have to be made by the Pond Machine Tool Company, and when the lathes are built they are to be erected at the Army gun factory at Watervliet West Troy, N. Y. They have eighteen months' time in which to complete the contract, and the amount of the contract is over $200,000

There is an impression among many engineers that a correctly balanced locomotive could be built with four cylinders, two inside and two outside; the cranks and reciprocating parts of the inside connections acting as a counterpoise to the outside connections. A well-known engineer, talking on this subject the other day, expressed the belief that an engine of this character would be subject to disagreeable vibration, and that the shocks and strains now transmitted to the rail and frame would be sustained by the axle and would consequently make the axle much more liable to breakage.

Equipment Notes.

F B Hitchins, of Detroit, is in the market for 200 refrigerator cars.

It is rumored that the Monon route are in the market for 1,000 cars.

The Southern Pacific are said to be in the market for ten locomotives.

The Produce Dealers' Despatch Line, of Chicago, have ordered fifty cars.

The Baltimore & Southwestern are said to have ordered 800 box cars from Pullman.

It is said that the Cold Blast Refrigerator Co. of Kansas City are in the market for 200 cars.

It is reported that the Jacob Dole Packing Co. of Kansas City have ordered fifty refrigerator cars.

There was a rumor that the Baltimore & Ohio had ordered 200 freight cars, but it has been contradicted.

The New York, Susquehanna & Western have ordered 200 coal gondola cars from the Bloomsburg Car Co. It is reported that the Company are about to order several locomotives. They talk of having Wootten locomotives adapted for burning slack coal.

A bright ray through the clouded railroad situation in the West, is the news that General Superintendent Welby, of the Rio Grande Western, has issued an order restoring the wages of all trainmen which was reduced 10 per cent. in October last.

E Harrington, Son & Co., Philadelphia, are not complaining of hard times, although business is rather quiet. They have taken advantage of the lull to effect numerous improvements in their shops, with a view of being better prepared for the rush of business when it comes. Their new superintendent, Mr. McGregor, is busy making special tools, jigs and formers, with the view of improving the staple appliances made, and for securing uniformity at the lowest expense.

Especial attention is called to the handsome educational chart accompanying this paper. The copper plate of this alone cost more than $100, and is one of the finest pieces of work ever turned out. Every one of the 30,000 sent out deserves a frame. They are educational, and represent the highest development of the American locomotive up to March 1, 1894. Chart No. 3, the Triple-Valve, will go out on May 1. It will be a working model of the valve and the best educator on brakes ever devised.

In January, 1893, we thought we did well when we were paid for and entered on our list 4,550 names. During the month of January this year we were paid for and entered 7,583 names, new and old, and are correspondingly happy. We have now over 16,000 names on our mailing list, and the News Co. are taking over 4,000—and we are only just getting into the subscription business for the year. From February first to June first last year we entered more names for the year than we did in January, and there is every reason to expect an increase this year. LOCOMOTIVE ENGINEERING now has far and away a larger paid circulation than the *Railroad Gazette*, *Railway Age*, *Railway Review*, *National Car Builder*, *American Engineer and Railway Journal*, and *Railway Engineering and Mechanics* (*Master Mechanic*) combined. Our mailing lists and News Company orders are always on exhibition to anybody who cares to prove the above statement. More railroad officials *pay for and read* LOCOMOTIVE ENGINEERING than any other paper—we are loaded on this subject. This paper has a larger foreign circulation than any other American railroad paper, having more subscribers in Australia and New Zealand alone than any of the others send out of the United States altogether.

In a circular issued by the Traveling Engineers' Association, calling for information on the operating of locomotives, the question is asked, What is the average time your engines are waiting for trains? This is a small question with a big tail to it. On some roads the engines are expected to be sent to the starting point for the train at the schedule time, and then they often stand for hours waiting. In this kind of waiting service, coal is burned sufficient to pull the train over a considerable part of the trip. With the telegraph system now in use there is no excuse for keeping engines waiting in steam for hours to take out trains that are late. It indicates bad management if the motive power department is not kept informed of the hours at which trains may be expected to arrive. This useless waiting for trains wastes more fuel than those responsible for it are aware, besides keeping crews on duty many extra hours. The expensive leak ought to be stopped, and the Traveling Engineers will do an important service to railroad companies if their investigation directs attention to the magnitude of this waste.

Hard times have come again and with them the old complaint that a mechanic has no future in these days of fierce competition for the means of living. This complaint has been repeated to us until we are tired of hearing it. We acknowledge, sadly, that mechanics are having a hard time of it in these days of short hours and low pay, but we cannot see any other class which is more fortunate. There is fierce competition in every department of labor, and, naturally, every man who is suffering considers his own case the worst. High and low, men are finding their incomes decreased, but of course it presses hardest on those who earn little margin above a mere livelihood. When the broad field of labor is closely surveyed, and the condition of all the members noted, we do not think there is any reason for a mechanic to regret that he had not learned some other business, especially if he be a good mechanic.

On the bank of the clear flowing Delaware River, in a small valley in the suburbs of Easton, Pa., the Bushnell Manufacturing Co. have established fine new works for the manufacture of car seats. They have fine, light, airy shops, equipped with all the most modern appliances for facilitating the work. Mr Bushnell says, that although business is dull, they have enjoyed a fair share of the few orders given out, and that their street-car seat business has been better than they expected it would be. A visitor examining the work done in these shops, is struck with the care exerted with the very smallest details, to render the production durable. They have lately effected some valuable improvements upon their passenger car seat which simplify and strengthen the swinging mechanism. This mechanism, which is independent of the arm rest, has always been popular and the new pattern is likely to make it more so.

We have received from Mr. William Kemp, Glasgow, Scotland, a blue print of a triple-expansion locomotive which he has designed and patented. The engine has three cylinders, two outside the frame and one inside. The low-pressure cylinder is inside the frame and the intention is to keep it hot by the smokebox gases. The steam passes from the boiler to the steam-chest of the high-pressure cylinder. After being used in that cylinder it passes to the intermediate cylinder on the other side, and from thence to the low-pressure cylinder. The drawings show indications of ingenuity and good designing ability. The inventor is willing to give the first railroad company which will adopt the engine the privilege of doing so without payment of royalty.

On the retirement of Mr Edward Hedley from the position of master mechanic of the Brooklyn Elevated Railroad, on Feb. 1st, the men who worked under his direction made him a present of a magnificent set of drawing instruments. Mr Hedley has only been at the head of the mechanical department of this road for a year and a half, but he made fast friends among the best men, because he treated them with justice and consideration. Had Mr Hedley been less of a mechanic and more of a ward politician he might have gone higher in office over in the politician-ridden town "forninst" New York.

Under the heading, "Remarkable Angling," a new Brunswick paper contains detailed particulars of how Master Mechanic Haggerty raised a heavy locomotive out of the bottom of a deep lake, where it had gone while operating a heavy push snow plow. The fireman went down under the engine. This was another victim to the dangerous practice of attempting to clear off heavy snow with an obsolete machine. There is nothing more dangerous than rushing into deep snow drifts with push plows, and the practice ought to be prohibited, now that there are safe appliances for doing this work.

We were recently informed by a manufacturer of springs, in Philadelphia, that large orders for springs had recently been given out at a price for which good open-hearth steel could not be bought. That means that the tendency towards cheapness was calling for the manufacture of Bessemer steel into railroad car springs. We think it bad enough that any railroad company should be short-sighted enough to use Bessemer steel axles, but to accept springs of that material is preparing the way to fill their repair tracks with disabled cars.

From railroad men everywhere, from general manager down to trainmen, come words of commendation for the plan of disciplining men offered by Mr G. R. Brown, general superintendent of the Fall Brook Railroad, in the last issue of this paper. We move that where this decent, manly, and honorable plan of dealing with men is adopted, it be called the "Brown Plan," in honor of the man who originated it. Mr. Brown may have a monument in this that will eclipse anything that could be built of marble or bronze and he deserves it.

When a railway accident happens in England, the daily papers are exceedingly free and frank in expressing their opinion of where the blame belongs. When a collision happens and is due to defective stopping or signal appliances, the papers never fail to tell that the true remedy is to pass a law requiring a director of the road to ride on the front platform of the locomotive. If a law of that kind should be enacted in this country we would hear fewer excuses for failure to equip railroads with signals and other safety appliances.

An engineer at Victoria, B. C., writes to say that for two years he has been using a device for releasing driving-brakes independently of the train. He has a $\frac{1}{2}$-inch pipe tapped into the lower head of driving-brake cylinder, and leading up into cab with a common globe-valve on it, this is located beside the engineer's valve. By its use he can stop the sliding of the drivers without letting brake off, and also finds it very convenient in switching, especially if in a hurry. It is just as effective with automatic as with straight air.

Mr S. W. Johnson, locomotive superintendent of the Midland Railway of England, has lately designed a new passenger locomotive which has some peculiar features. The engine has a single pair of driving-wheels, 90 inches diameter, and has a four-wheel truck in front and a single pair of carrying wheels under the deck. The cylinders, which are inside the frames, are 19 x 26 inches, and are inclined upwards towards the driving-axle. Piston-valves are employed and they are set beneath the cylinders.

At the Middletown shops of the N. Y., O. & W. they recently took out a wrought iron back axle from an eight-wheeler that showed considerable wear. The axle was new just twenty months before, having been put in May 12, 1892, and taken out January 12, 1894. The bearings were originally $8\frac{1}{4}$ inches in diameter and $8\frac{1}{2}$ inches long, one of these was worn to $7\frac{3}{32}$ inches in diameter and the other to $6\frac{3}{4}$ inches. This engine has a weight of 73,000 pounds on her drivers, and made in the time given a distance of 128,669 miles.

The Pennsylvania Railroad Company are making careful experiments to test the value of the Harvey hardening process as applied to tires, crank pins, axles and other parts of rolling stock subject to rapid wear. The indications of material reductions of wear are very promising. Many railroad men are watching these experiments with keen interest. If they prove as successful as expected, that process will prove of incalculable benefit to railroad companies.

One of the most idiotic fakes we have seen in print lately was a long article in a Cincinnati paper, saying that the Erie people were about to adopt a buffer brake for the whole of their rolling stock. The statement was made that the company named had had 100 cars equipped with the brake, and its working was so satisfactory that they were about to discard the air-brake. There is not a word of truth in the story.

In a paper, read before the German Society of Engineers, by Herr Lentz, a statement is made that there are 109,000 locomotives in use in the different countries of the world. There are said to be 63,000 in Europe, 40,000 in America, 3,300 in Asia, 2,000 in Australia, and 700 in Africa. Of those used in Europe, Great Britain and Ireland is credited with 17,000, Germany with 15,000, and France with 11,000.

On a North British railway they have in use a system of car heating, in which the exhaust steam from the Westinghouse air-pump is used to do the heating. We are afraid that this system would give very little comfort to passengers in cold weather.

The existing depression in business caused the Niles Tool Works, of Hamilton, Ohio, to greatly reduce their force, and to diminish the working hours to eight hours a day. They have now begun to work ten hours a day, and additional men have been given employment.

Something over 300 copies of our prize drawings have been asked for and sent out, this ought to mean some original ideas offered for the benefit of the railroads and the men who run locomotives on them.

The great miracle of modern engineering is the converting of the impossible of yesterday into the practical of to-day.

* Railroad Coppersmithing—VII.

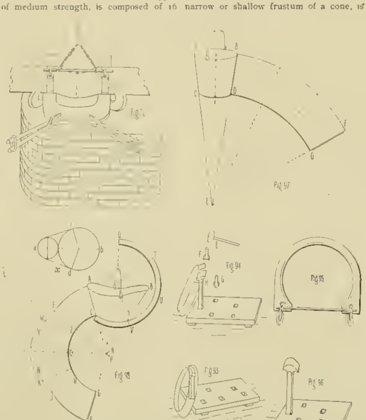
By John Fuller, Sr.

BRAZING SHEET BRASS

In both locomotive and marine shops there is sometimes considerable ornamental brass-work of various kinds, such as edgings for splashers, moldings, casings for domes, valve chimneys and covers, hand-rails, and a variety of other work, and I have often witnessed a great deal of annoyance and disappointment among workmen, myself included, on account of their want of knowledge in relation to the laws of expansion and contraction while attempting to braze joints for the completion of their work. Then, again, the many different kinds and qualities of brass made and sold often lead men into trouble, partly through the deception of a dealer or manufacturer, but mainly through their own ignorance of the nature of the material they are expected to work up. There are so many mixtures called brass that a workman may encounter a failure when least expected, unless he is quite familiar with them or on the alert and wary. After much unpleasant experience in this direction, it has been learned that when one is working on sheet brass of an unknown quality which it is required to solder together, before the work is begun it is best to take a small corner piece, and try its merits with such spelter as may be at hand. If the solder can be made to run with ease on the scrap being tested, there will be no further trouble. But if it will not run on it, then it is desirable and necessary that some should be procured that will. After the work has been cut out, there are usually some scraps that cannot be used to advantage for anything, take a portion of these scraps, if there are any (if not, a portion of the sheet, say a pound), and having provided a small crucible, melt the scraps with some borax, and in the meantime have an ounce of zinc melted in a ladle. When they are both in a liquid state, mix in the zinc and stir with a hazel stick or chisel-rod, then pour it out, and when it has cooled enough so that it will only char the hazel rod, break it up into small grains in an iron mortar, and then try its merits on another scrap of brass. If this new composition, now to be used as spelter, is found to require too much heat, melt it again and add a little more zinc, until it will run with safety to the work in hand—that is, without fear of burning the parts adjacent to the joint, or having the cramps fall off from excessive heat. Brass made to have a silvery hue when polished is always difficult to work, and requires the utmost vigilance while being brazed together, and much experience is necessary as well in the preparation of the work for that operation. In some instances it is necessary to add a little silver to the spelter in addition to the zinc, which will reduce the amount of heat necessary to run it, and add much to its malleability. The quantity required, however, will necessarily depend on the kind of brass, and must be left to the scrutiny of the operator. Having procured a spelter suited to the brass, let us suppose we have a job similar to that of the moldings shown in Figs. 88 and 89, requiring a strip of sheet brass 11 inches wide to be joined and brazed together, then trim the edges of both ends and thin them and cramp one with a chisel. The next step is to prepare a frame from a piece of ½-inch boiler plate, Fig. 92, in the shape of a horseshoe, some 4 or 5 inches wide, and about 15 inches long in the legs, also two screw clamps, *C*, and two pieces of bar iron, *D*, strong enough to hold the brass fast on the horseshoe frame when the clamps are applied. Bend the sheet in form shown, so that when the joint is brought together within the horseshoe frame it will hang in a curve or bag between the legs of the frame. Now bring them together; open the cramps, and let them receive the end of the other piece, and screw it fast to the plate with the clamps. Through the eyes of the screw-clamps pass an iron rod, and hook the two ends of a short chain to the rod, and then sling the whole thing to the traveling chain overhead. Take it now to an anvil and close down the joint, and be careful to take out all the spring from the parts about the joint before going to the fire. When at the forge apply two pair of tongs, and see that the work is slung so as to balance and hang level. Then chatter the joint and jar some liquid borax through, charge it and dry slowly. Then, with a slow fire heat the parts within the frame gradually until the solder is all down; then with a gentle fire the joint may be easily and successfully run down.

BRASS SOLDERS OR SPELTER

The strongest spelter used by coppersmiths for heavy work is composed of 3 parts of copper and 1 of zinc. Another is made of 8 parts of old tubes or Bristol brass and 1 of zinc. Another, for copper of medium strength, is composed of 16 parts of copper and 12 of zinc. For the better kinds of brass equal parts of copper and zinc.



COMPOSITION OF BRASS

It may be well to notice here some of the many alloys called brass, and their composition.

The following have been collected in a promiscuous way as opportunity offered, and are here presented for the benefit of the boys and those interested

	Copper, ounces.	Zinc, ounces.
Bristol Brass	16	6
Muntz Metal	16	10⅔
Pale Yellow Brass	16	12
Muntz Sheathing	16	16
Mosaic Gold	16	17
	Copper, parts.	**Zinc, parts.**
Brass, reddish yellow	86.6	11 4
Prince's Metal	83 0	17 0
Rolled Brass	79.6	20.4
English Brass	74.6	25 4
German Brass	66 2	33 8
Watchmakers' Brass	49 5	50 5
Pinchbeck	88 0	11 0
Tombak	44 5	15 5
Manheim Gold	70 0	30.0
Button Brass	30 4	69.6
Bath Metal	32 0	9.0

There are many other compositions called brass. It will be readily seen that the workman who is ignorant of the many alloys commonly called brass, and incapable of judging or even forming an intelligent opinion as to the quality of the brass or the solder necessary for the particular kind he may be called upon to work up, can very easily and innocently fall into an error, and be placed in a very unpleasant position. I have found but little charity shown to workmen, or by them, when innocent failures of this kind have happened, and I have had my share. It is hoped the tables above given may be the means of assisting the young workman, and old ones too who are willing to learn, to avoid the chances of failure likely to occur in working of any of the poorer kinds of brass, if called on to do so.

WORKING UP BRASS MOLDINGS.

We will now form up and proceed to complete our brass moldings, supposing the directions given on brazing sheet brass has enabled us to successfully join together the pieces which make up and complete the pattern. Then we are now ready to go on. The pattern for the smokebox end, which has now been formed into a narrow or shallow frustum of a cone, is taken to a suitable T-steak, Fig. 93, where the first course is executed to give the curve to the large end of the frustum ring, and thus stiffen it enough so that it can be handled without fear of collapse. When this is finished it is turned the other side up and the arch flange for the band is laid off on a suitable mandrel, Fig. 76, then it is hung on a steak, Fig. 94, having the same curves as the O G of the molding is required to be, and carefully dressed with a smooth-faced mallet to the curve of the steak while the brass is soft, when it has been roughly formed to the shape required, it is scoured clean with the aid of muriatic acid and salt, washed thoroughly and dried, when two swages made of block or ingot tin, Fig. 94, are brought into use, and with the aid of a helper and a suitable maul, *E*, the molding is swaged on the cast-iron steak, *H*, Fig. 94—first the convex curve with the swage *F*, and then the concave curve with the swage *G*. If this work is carefully performed, a nice clean, smooth job will be the result, and no filing or sand-paper necessary to prepare the surface for polishing.

The middle molding is worked into shape in a similar way, except the two legs of the pattern *N*, Fig. 89, are put into shape and roughly fitted to their places before being joined or brazed to the other part of the pattern. When the legs have been prepared sufficiently and the whole joined together, put it into shape and fasten the legs in the right position with a light flat bar about 1¼ x ¼ and screw clamps, Fig. 95, then proceed as before directed by turning in the edge for the firebox and turning out the edge for the boiler; then on a steak having the same curve and O G the molding is wanted, dress it to the form desired, scour as before and then swage up smooth, as shown in Fig. 94.

The molding at the feed end of the firebox is formed up in a similar way to the other two, the arch being partly prepared before the legs are joined to it. When the legs have been brazed on, it is put into final shape and held there by a bar and screw clamps, as shown in Fig. 95, and swaged smooth on a steak, Fig. 96, of the same shape as the molding is designed to be.

FITTING MOLDINGS.

Fitting moldings and copings for lagging is rather a particular and trying job as a rule—at least it was when I first tried my hand at it—because the two that encircle the boiler were made in two halves and slipped into a joint at the top of the boiler, and then when the wooden lagging had shrunk and the band got a little loose the halves would nearly always shake out of place, and because men would get impatient and get the stud holes wrong, and the fitters put in male studs instead of stud bolts to receive a set screw, so that after a few months' running the lagging being loose and out of place, the moldings, instead of adding to its beauty, would give it a dilapidated appearance, as if the engine had been at work for years. We put these moldings on in two halves for quite a number of years, as it seemed there was no other way to do it, until one day after finishing a brass one for the smokebox end, and when about to saw it in two, my attention was called away and leaving one cut completed, the molding was hung up out of the way for several days. On my resuming the job again, while getting it down, one end dropped, and I noticed the span made by the two ends when dropped apart. I pulled it a little farther, and noticed it was apart enough to span the boiler, and instead of cutting the ring in two halves as usual, I tried the experiment of putting it on without cutting by pulling it apart like one coil of a worm and slipped it around the boiler, and was delighted with the success of my experiment, because I could now put the strap on, screw it up and scribe the edge of the molding to the smokebox plate, take it off once to trim, and then when put on again have it fit perfect to the smokebox plate. This was a great improvement on the old way, for while they would occasionally get loose there was no joint to fall apart, and it can be readily seen that it was a very much superior job. The molding at the front end of the firebox, of course, had to follow suit, and was afterward put on in one piece, and the absence of the joint at the top added very much to the appearance of the work when completed. The fitting of molding at the feed end of the firebox suggests itself. All that is necessary is a little patient care to fit it around the various fittings attached to the end plate, and the proper kind of bolts and set-screws to hold it fast to its place.

WATER-PAILS AND COAL-HODS.

On most railroads at this time of the year there is a heavy demand for coal-hods and iron buckets, which are often made by the coppersmith, although they are more often made in the tinshop or lamp shop. The South Eastern Railway in England manufactured most of their supplies of this kind. While in their employ I made a great many coal-scoops for them, also water-pails or buckets. It often happens there is but very poor convenience in these shops with which to turn out this kind of work with anything like facility. They are, as a rule, made by hand, on purpose to fill up time that

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might otherwise be used to less advantage. Now, there are boys, I presume, in most railroad shops who would like to know how to cut out the patterns for pails and coal-hods. Boys often pass by a thing that is familiar to their eye without enquiry, paying little heed until their attention is arrested by a request to make it, and then find themselves at once in a fog. To those who are willing to learn we are trying to clear away a little of the mist, and help them to become proficient and independent workmen. A water-pail, or fire-bucket as we used to call them, as shown by Fig 97, which is the frustum of a cone; and a coal-hod or coal bucket, as will be seen, is about the same thing with the addition of the lip, Fig 98. Now, we will suppose we want to make some water-pails of the dimensions shown in Fig. 97. The first thing again is the pattern, which we obtain as follows. Make $A\ B$ 12 inches, $B\ D$ 9 inches, and $C\ D$ 8 inches. Produce $A\ C$ and $B\ D$, and let them meet in E; then with $E\ B$ as radius describe the arc $B\ F$, making $B\ F$ equal to three times $A\ B$, then with $E\ D$ describe the arc $D\ G$, and join $F\ G$. Now add enough to both ends, parallel, as shown, for the groove or seam, and $F\ B\ D\ G$ is the pattern required. Now notch the pattern, as shown at G and F, at both ends of the pattern, and if the shop is provided with proper machines form up in rollers, ream and wire; but if there are no machines, turn the edge and wire loosely before the pattern is turned or formed up; when formed, round up true and put the bottom on. If a foot is required to the pail a ring made of suitable hoop-iron and fastened on with four rivets answers the purpose well.

Now, it happens sometimes that a vessel similar to this pail is required to hold a stated or definite quantity, and only the diameter of one end is given, with the height, or the two ends given and no height, these two conditions have caused much unpleasant guesswork, and often great disappointment, and I shall endeavor to make the solution of these two problems so plain that boys having a good common school education can easily solve them, because they bothered me for some years before I could solve them, although I searched in every mensuration I could lay my hands on. Let us suppose we have an order for pails to hold three gallons, the top diameter, $A\ B$, Fig. 97, to measure 12 inches, and the height, $X\ Y$, to measure 9 inches. Here you see the diameter, $C\ D$, is not given, and we are left to find out what the bottom diameter should be. Now, the way to find the solid contents of the frustum of a cone is to add the arrears of the two ends to the square root of the two areas multiplied together, and then multiply this result by one-third the height, thus:

$$(AB^2+CD^2+\sqrt{AB^2\times CD^2})\times\frac{.7854\times 9}{3}=\text{the}$$

contents in cubic inches; then working this back to find the size of the end not given, we proceed thus Three gallons $= 231\times 3 = 693$ cubic inches. If we divide 231 or the number of cubic inches in a gallon by .7854, we get 294.1 cylindric inches, and to avoid using this decimal .7854 in the operation we will take the number of cylindric inches in a gallon instead of cubic inches, then $294.1\times 3 = 882.3$ or the number of cylindric inches in three gallons.

Here, for the diameter of the end we are going to find we must substitute in its place some sign or letter; let it be D, then proceeding according to the rule, we shall have

$$12^2 + D^2 + \sqrt{12^2\times D^2})\times\frac{9}{3} = 882.3,\ \text{or the}$$

cylindrical inches in three gallons

Now, $882.3\div 3=294.1$, or the value of

$$12^2+12D+D^2=294.1$$

Deduct from each side

$$12^2 \text{ or } 144 \qquad = 144 \text{ we have}$$
$$12D+D^2=150.1$$

Adding the square of 6, or one-half of 12, the coefficient of D, to complete the square again, we have

$$D^2+12D+36=150.1\times 36$$

That is

$$D^2+12D+36=186.1$$

Extracting the square root of each side, we have

$$D+6=13.64$$

Deducting 6 from each side, then

$$D=7.64$$

Here we find the water-pail or fire-bucket which will hold three gallons, whose top diameter is 12 inches, and whose perpendicular height is 9 inches, the bottom must be 7.64 or a little over 7⅝ inches. Again, to make this plainer to those who may not understand the last solution. Find the number of cylindric inches in the pail or other similar vessel required and divide it by 3. From that subtract the square of the diameter of the end given; to the remainder add the square of one-half of the given end. Extract the square root of this sum, and from the root subtract one-half of the diameter of the given end, and the difference is the required end, thus:

EXAMPLE.

```
   294 1—Cylindric in. in a gal.
       3—Number of gals. in a vessel.
  ------
 3)882.3—Divide by 3.
  ------
   294 1
   144   —Subtract 144 sq of dia. given.
  ------
   150.1
    36   —Add 36, sq. of halt dia. given.
  ------
   1 86.10
   1           1.3.64. sq. root of sum.
  ------         6     subtracting 6, one-half
 23)86                     of given dia.
    69         ------
  ------       7.64=dia. of end required.
 266) 1710
      1596
  ------
 2724) 11400
       10896
  ------
         504
```

When I had discovered this rule and learned how to work it successfully, I found it of great service, and those who will take the time to learn it will also find it very useful.

We will now suppose we have the diameter of the two ends given, but no height; that is to say, a vessel to hold 4 gallons, whose top diameter is 12 inches, and the bottom diameter 9 inches. Here, as before, we must have a substitute for the number representing the height. Let it be H. Then, as shown before.

$$(12^2+9^2+\sqrt{12^2\times 9^2})\times\frac{H}{3}=\text{Contents of the}$$

pail in cylindric inches.

Now 4 gallons $= 294.1\times 4 = 1176.4$, and proceeding in accordance with the rule, we have,

$$144+81+108)\times\frac{H}{3}=1176.4$$

That is

$$333\times\frac{H}{3}=1176.4$$

Clearing this fraction, we have

$$333\times H=1176.4\times 3$$

Or,

$$333\times H=3529.2$$

Then,

$$H=3529.2\div 333$$

Therefore,

$$H=10.598$$

By this operation, we find that the perpendicular height is 10.598, or ten and six-tenths inches, as was to be shown.

COAL-HODS

The sizes of coal-hods are designated by inches, thus 15, 16, 17, 18 inches; that is, the rule is laid diagonally across from the top of the lip to the opposite side of the bottom, and this measure indicates the various sizes. It will be noticed by the reader that there are very many different patterns of coal hods made to the various makers' taste, but the point most desirable to keep in view, is economy in cutting the sheet; that is, to cut with the least waste. Let us mark out the pattern of one taken at random from among the many styles, and work it up to measure 17 inches, as shown by Fig. 98. This, you will see, is similar to the water-bucket, Fig 97, with the addition of the lip. The plan of the mouth of the hod is indicated in x by parts of two circles a and $d\ b\ c$, and the tangents. The elevation is shown by the outlines of the hod itself, Fig. 98. To develop this we proceed thus Extend the lines $A\ C$ and $D\ B$ until they meet in S; then with $S\ C$ as radius describe the arc $C\ O\ G$, and make it equal to three times $C\ D$ as indicated by $A\ M$, $M\ K$, $K\ F$. Now divide the arc $C\ O\ G$ into four equal parts, $G\ H$, $H\ O$, $O\ N$, $N\ C$. From O, with a radius equal to $D\ B$, describe the arc $N\ Y$; continuing it from N to K, and from Y to M. Then from the point R with $S\ A$ as radius describe the arc $A\ E$, making $A\ C$ an inch longer than $E\ N$, and from the point P with the radius $S\ A$ describe the arc $F\ J$, making $F\ G$ an inch longer than $J\ H$, and each arc equal to $d\ b$ and $b\ c$ in X. Now, with the same radius $S\ A$ on the lines $S\ L$ and $S\ W$, and from the points S and W, describe the arcs $E\ M$ and $J\ K$, then $A\ M\ K\ F$ will be the curve of the pattern for the mouth of our hod, and $C\ O\ G$ equal the size of the bottom. Now add enough for seam to each end, and parallel with them, as shown at $F\ G$, and $A\ M\ K\ F\ G\ O\ P$ will be the pattern for the body.

To mark out the foot proceed in a similar way as before. With $X\ V$ as radius, and from the point X describe the arc $V\ U\ T\ Q$, making it three times $C\ D$, and with $X\ D$ describe the arc $D\ Z$, join $Q\ Z$ and $D\ V$, then $Q\ T\ U\ V$ is the pattern for the foot. Having the pattern for the body and foot, notch the body as shown in F and G, and then fold and wire before forming if there are no machines at hand for wiring; if machines are provided, then form before wiring, after the wiring is completed, double-seam the bottom on. Now make the foot in a similar way, and rivet on with six rivets, and complete the hod with a bail and back-handle. Hods made in this way are more durable than many others offered for sale on the open market.

There are some more complicated methods of obtaining this coal hod pattern; but I have endeavored to make this as simple as possible, and near the truth enough for all practical purposes, believing it will be more readily understood.

Around the World, to China, and Home.

Notes taken by E. J Lewis, an American Engineer Who Went to China with the First Air-Brakes.

(Concluded)

A part of the trip was through the latter end of the Inland Sea coming from Yokohama, Nakasaki being the first stop for coal, which is mostly done by Japanese women by placing ladders made of bamboo up against the side of the boat and having small baskets filled with coal, and pass them up from one to the other along the ladder till reaching the top. Ships taking hundreds of tons are loaded that way. Next stop was at Chemulpo, in Korea. The Koreans are a branch of the Chinese and pay tribute to the Chinese Empire, keeping them very poor by heavy taxations. Some of them are powerful men, but very low, degraded looking people, living in filthy mud houses We visited a Korean village, and was met at the shore by a lot of naked children and dogs, who followed us nearly everywhere we went. Their money was so small that when we would buy small things, for relics, we would give them, say, 5 or 10 cents, they would seem in doubt as to whether it was good. Little stores, with a few cents' worth in them, resembling children playing at storekeepers, was seen. When returning to our boat to go aboard, came through the market place, where old women and men were assembled, offering small fish and green stuff for sale on a small scale, and with such vile-smelling surroundings that you would wonder why they did not die with the small-pox or some such disease. The high class of women do not appear in public without having their faces covered similar to the Egyptians. Only the married men wear their hair curled up on top like a woman, and the women wear pants like men. All these seaport towns have a portion of them set apart for foreigners. When our American people go to realize the pleasure of being an American Consul at such places, their desire for honor must be very great, if they know anything of such places before going. While lying in the harbor, the tide went down so our boat was resting on the ground, and a typhoon ended its career, just the tail end of one, the captain said, which gave us an idea of what it was like at its best in the open sea. Small boats in the harbor were commonly turned over so that no unloading or loading could be done that day.

Left Chemulpo for Chefoo across the Yellow Sea, which took twenty-four hours All the next day ran along the China coast, occasionally passing a wreck of some ship, some of which were stripped by pirates shortly after the accident

It was not a very pleasing land to look upon, nearly void of vegetation, and of red, burnt appearance, as if there had been considerable volcanic eruption at some time. Cheefoo is the Atlantic City of China, where the foreigner spends the warm season, having good hotels and a nice sandy beach. We took our first dinner in China as soon as we could get ashore. It was an interesting sight while anchored at Cheefoo, surrounded by hundreds of Chinamen, all screaming and scrambling on board, up the sides of the boat, anywhere they could catch hold of anything, reminding one of pictures of ships being attacked by pirates. Sometimes, just for sport, one of the sailors would pour a bucketful of water on a fellow just about to make his way on board, but it did not seem to dampen his ambition the least to get on. While in port the passengers are advised to keep their cabins locked as some one might take possession of small things laying around.

Left Cheefoo that night at 10 P. M. for Ta Ku, across the Pechili Gulf, the water was as smooth as a river, arrived at the bar next afternoon As the tide was up, had no trouble in crossing the bar to the entrance to the Pei Ho River going up to Tientsin. A short distance up the river is a small place called Tong Ku, where they usually take the train when the river is not high enough to permit the ship to go up to the city (Tientsin)

Anchored over night to allow the ship to be lightened up to twelve feet to get up the river. Special pilots are required to take the boat up and down. After being nearly devoured by mosquitoes and sand flies, got away at 4 A. M up, surely, the crookedest river in the world.

It is twenty-five miles by rail to Tientsin; it is about fifty miles by river. Frequently in the bends of the river the ship would take a run out on shore, sometimes into a Chinaman's garden, but does not seem to damage the ship any, as the shore is soft ground with no stones in it. The boat easily slides back in again. The river is a narrow stream not over 300 feet wide at the most, with the surrounding land only a few feet above the river, so that a flood is a common thing. All along the river live Chinamen engaged in gardening, irrigating from the river by dipping water out of the river into ditches running back to their gardens. Occasionally small boys would run along the shore yelling at people on the boat, we were told by natives, "Foreign devils coming!" saying, "Mousa laila." To see a boat across the country you could not say which way she is going, up or down, unless you are familiar with the river.

Arrived at Tientsin about noon, which presents a busy scene. This is as far as the boats run. Thousands of coolies are at work on Bund loading and unloading ships, singing from morning till night. A warehouse in that country is called a godown.

The principal part of the city runs from the river and is occupied by foreigners. There is probably 500 persons living in Tientsin. On the Bund is noticed a high pole with a cage-like box on top, containing a Chinaman's head. It is put there for an example of the result of crime; this keeps it constantly before their eyes. Many people think, in China a fellow gets his head sheared off for most anything he does, which is not true. It is only for crimes such as we hang people for; he is given a trial, and executions must be approved by the Emperor. Firm and severe measures are necessary to govern these people. They do not seem to have any sympathy for one another, as other people, could stand and see one of their number tortured and smile at it. Those that come in contact with foreigners that treat them right will be used the same, and a foreigner would have to misuse them very bad, and it become generally known among a large number of coolies before there would be any danger of being molested by them, which would be their taking the offender out, giving him a beating with bamboos, called by them the "bamboo chow." This is why a man disposed to do right or wrong with them has so much influence. You will not find any people more appreciative than the Chinaman.

Soon after landing we engaged coolies to take our baggage to the Astor Hotel. Two of them wanted to carry the type-writer and got to quarreling over it, letting it fall in the scuffle. One threw the other down, swearing in plain English. I felt better among them at once; felt as if I was among civilized people. We reported at once to Mr. Wm. A. Pethick, assistant managing director of the Imperial Chinese Railways, the first foreigner ever honored with such a position among the Chinese. Shortly afterwards went to the Postal Telegraph Office to say to our friends we had arrived, and found the one word, "arrived," would cost $16.64. Our folks found us people of few words. We arrived August 27th, just about fifty-two days going over. In a few days we were ready to get to work.

The Chinese railways consist of about 140 miles in operation and something like 600 more under construction, to be added on from time to time as ready for traffic. One division runs from Tientsin to Tong Ku south, and the other division runs from there toward the north to Tong Shan, where the shops and mines are located. It is twenty-five miles from Tientsin to Tong Ku. It was thought best to put the air-brakes on at Tong Ku Junction, as the facilities were found sufficient, and this would allow us to stay over night at Tientsin. Mr. A. Sherriff is engine house foreman at Tong Ku. Mr. J. Buchanan, J. Fenwick and R. Terriss foreign engine drivers, and Mr. Thomas Preston, track supervisor, gave us their assistance and advice, aiding us materially among the natives. All the workmen given us were natives, many of them good ones. Mr. Hsieh was our interpreter, a native of remarkable patience, as he had to talk for us at every part of the work, which must have been very trying at times. Considerable credit is due Mr. F. W. Newell for the various provisions he made in taking many tools and material he thought might be needed.

On September 30, 1892, engine No. 14, of the 8-wheel class, and a passenger car was ready for trial. That day Mr. Pethick and a few of his Chinese friends came to Tong Ku. I ran the engine the first trip to Tientsin, with Mr. G. Sherriff acting as pilot and Mr. W. S. Hamilton the return trip. Everything worked just as it should and was highly approved by all present. In the next thirty days the other engine, No. 16, of the 10-wheel class, and the balance of the cars were finished. In November Mr. Newell returned to America, going by the way of England, leaving us there during the winter to attend the care of air-brake apparatus and to see to anything that might take place during that time, and instruct the employés in the use and care of it. The Chinese railways are run almost entirely upon the English system in all its departments. The trains are moved by the staff system.

To any one accustomed to riding on trains, moved by such rights, would be nervous about riding on trains in America. When returning I saw the difference and thought of the apparent safety of the staff system. It did seem dangerous, but when you stop to consider, with the staff system but little interest is needed by the men further than not forget the staff when leaving the station; the result is, a man is depended on after all for the successful movement of the train. While on the other hand the very best men are selected through years of training, and the rules and movements drilled into the men while they are young. The result is that a set of men are produced that fully make up the difference in the two systems. The increased responsibility resting on the men is calculated to stimulate their powers and attention to their duties, while the other is so much the opposite. It is doubtful whether it is any safer than our system so long as man is depended on. It is doubtful whether the heavy traffic in this country could be handled successfully by the staff system. It is hardly likely in many years to come that trains can be handled by any other system in China and Japan than that now practiced.

Railways in China are extending up toward Mongolia, apparently for military purposes, as the Russians are crowding down toward China all the time, and will soon have a railway from their capital, St. Petersburg, to the Pacific coast, near Manchuria. Should the China railways connect with this road a person could go by rail from Tientsin to Paris in twenty days. The principal trade of the railways in China is hauling coal from the mines at Tongshan to the steamers arriving from the south. China is estimated to have more coal than any other country. Coal is worth about $4.50 per ton at Tientsin. Something like 2,000 natives are employed at the Tongshan mines. This place is worth visiting; the whole thing is walled in, and all employés must pass out at one place and be examined to see if they have stolen anything, such as tools and pieces of iron and steel, which they sell to blacksmiths, when successful. Some of the coal is down 1,000 feet deep; a few Englishmen have charge of the mining; very large pumping machinery is necessary to keep the water out of the mines.

Not much coal is consumed by the natives, for they cannot afford to buy stoves and fuel. But little fire is needed outside of cooking for them. They put on clothes enough (if they have them) to keep from freezing. Charcoal and weeds, raked off the fields in the fall and winter, is the fuel mostly used. For this reason the country is raked clean, and during the winter, when the ground is dry as powder, caused by not having any rain from September till next June, and the country being level, they have very heavy winds during the winter, making it so dusty you cannot see twenty yards at times. Last winter at one time the wind blew for five days and nights very hard. They rarely have any snow during the winter, but the sun shines brightly when the wind doesn't blow much. A great many poor people in Tientsin, during a cold spell, freeze to death. The wealthy class of Chinese are liberal toward the poor in winter; many would die if they were not so. Tientsin is the residence of the Viceroy, Lee Hang Chang, the most enlightened official China has ever had, who has done more than any other Chinaman toward the introduction of foreign ideas for the improvement of the people.

The native portion of the city is surrounded by a brick wall probably 20 feet high, having gates to shut at certain times at night. It is estimated there are 1,000,000 people living in the city. Some of the streets are 8 feet wide; did not see many over 20 feet wide. Some of the thoroughfares are crowded with people, and a person going through there in a jinrikisha for the first time doesn't feel safe among them, not understanding a word they say. It is exciting to meet a high mandarin at that time. A coolie runs ahead, carrying something like a red umbrella, following him are soldiers on horses; then comes the fat mandarin in his glass-windowed Sedan chair, lined with expensive furs, being carried by several coolies, and in the rear following a few soldiers on foot. Everyone gives this procession the street. The mandarin hardly ever deigns to look at any one along the way.

The water supply of this monster collection of people is furnished from a river flowing past the city, by a line of coolies with wheelbarrows loaded with buckets of water, going from morning till night.

The language of the Chinese is not difficult to learn. I had a teacher for three months to see how much I could learn in that time. I think in two years one could do without English altogether with the people. To any one staying in that country the spoken language is very important to know among them, as you are much more respected by them. The language consists of about 40,000 words. A person knowing 1,000 words will get along very well among them. But few of the native teachers know more than 20,000 words. The Pekinese is the proper Chinese language, but strange to say a Hong Kong man coming up the Tientsin cannot understand it, although the same characters are used in writing throughout the Empire.

Allow me to say here, that nowhere could I find a rat market or any that knew of rats being eaten by Chinamen. On $3 per month they live very well. If a fellow had to he could live on $1 per month. There is this about the Chinaman, as soon as he has enough to keep him he works no more. A man having $500 would be independent for life. American people surely do not know what good servants and cooks they make or they would make use of them more, and then they would not be so hostile about them coming here. They are a harmless, inoffensive sort of people, very rarely drink, and not one-fifth the crimes among them as among other people. They are capable of high education, as several we met show. Take Mr. C. K. Yun, superintendent of telegraph, who is a graduate of Yale College, and the interpreter of the Chinese Minister at Washington, D. C., who was interpreter for the Railway Managing Directors while we were there. The railway company's telegraph lines are under native management (Mr. Yun). Paper recording machines are used. The operator sending a message does not necessarily need to know what the message is. A clerk writes the message out in Morse characters, hands it over to the operator, who sends it as written. It is received on paper at the other end written in English, then translated into Chinese. Mr. Yun thinks the telautograph may be a great thing in China, as they can send a message in the Chinese characters.

The Chinese are a people that do not travel much and have few luxuries, and railroads will not build very rapidly as the people do not need them. Then great mineral deposits, such as iron, coal, gold and silver, are lying idle, they seem to be satisfied to know they have them. Anything they can manufacture they do so regardless of cost. For instance, they make rifles at Shanghai for $32 that could be bought for $9.00. When China does awaken, great things can be done with her millions of people and her country rich in minerals; but there is one thing they lack badly, and that is timber. The railway ties must be imported, usually from Russia and Japan. Railways can be built for $10,000 (Mexican) per mile. They use ballast of granite rock delivered, broken, for about 14 cents per yard.

All the trains run in China are mixed trains, with only one foreigner, the driver. Occasionally a native fills the position of driver, and does very well as long as nothing serious happens to the engine. It looks very much as if they will in time, if encouraged, fill all such positions. The cars are ten-ton to twenty-ton cars. A train is rated so many wheels for a train, regardless of their contents. A train at times reaches as high as seventy cars, but when a heavy wind is blowing, and they cannot haul their train, must set off as many as the driver thinks necessary. It is remarkable how the capacity of the engines from time to time changes with different drivers, and is a good illustration of the evils of allowing work being left to the judgment of many persons. Very few people seem to realize the value of having a system of work being done under a fixed rule which is made through thorough trial and experience. Three men often go through the passenger trains taking up the tickets. The head guard, who accompanies the two men and looks on, is the acknowledged authority. If a man has no ticket or money, they just take him by the neck, divest him of clothing or anything he may have in sight, and deliver him over to the station master at his destination till he pays for his ticket.

But very little trouble is experienced under this practice. If a passenger knocks a window out, he must pay for it at once to the station master. A combination lantern for signaling the driver is a handy thing for the purpose. It has three colored glasses, so arranged that by simply pressing the handle any color wished could be shown. When stopping at a station the guards keep in sight of the driver, showing the white light. When desired to show a slow signal, green would be shown, and when the signal to stop was wanted, the red would be shown. A few brakes are set on the rear end on the passenger cars; then the driver would complete the stop with the engine. Nearly all the employés can speak some English, so a foreigner is not entirely lost at any time.

The railway company furnish houses for all their employés. At Tientsin, where the general office is located, part of it is set apart for a reading room, containing many valuable works on railways and books on China. We arranged to have the LOCOMOTIVE ENGINEERING sent to us, but were surprised to see it lying on the table, among other railway papers, in the reading-room.

We made preparation for leaving China about the first of March, 1893. On March 12, we took passage for Shanghai on the China merchant steamer *Hsin Fung*. Shanghai is the finest city we saw in the East; sailed for France by the French mail steamer *Caledonian* for Marseilles, arriving April 20th, thirty-two days on this trip, stopping in Cochin China, at Saigon, Hong Kong, Singapore, Colombo (a good place to buy rubies, if you know them when you see them), Aden; while passing through the Red Sea, buried one of our passengers, Suez, through the canal to Port Said, Alexandria, having a smooth voyage through the Mediterranean Sea, past Mount Ætna to Marseilles; thence to Paris for a few days (there is only one Paris), thence to Calais, across the channel to Dover, once more again where we knew what people were saying; stayed in London ten days.

Took passage on our American liner *New York* for America, arriving home May 11, in less than a year from the time we left home. Saw enough in that time to think of for years, and had a good training in the practical application of air-brakes to engines and cars. I had no idea of saying much when starting this letter, but if it has been of interest I am repaid.

Warrenton, O. E. J. LEWIS.

The only encouraging thing about the business of manufacturing articles for railroad use at present is that numerous rumors are in circulation about roads that are thinking of ordering new equipment. We are afraid that the thinking in most cases is going to be long drawn out, but it is something to know that there are a good many railroads that would like to order new machinery if they only saw their way clear to pay the bills.

The Coming Convention of Air-Brake Men.

Less than a year ago sixteen air-brake men assembled at Pittsburgh, Pa., and formed an association of their own, this has already grown to a membership of over seventy.

These air-brake men will hold their first annual convention at the Park Hotel, Columbus, O., on April 10th, and some very interesting papers have been prepared by the several committees. There is no doubt whatever that these men will go into the details of brake repairs, maintenance and handling more thoroughly than any other body of men. Why shouldn't they? It's their pet hobby. As one of them writes "This will be a feast for air-brake 'cranks.'"

We would particularly urge railroad heads to encourage this little association, send their air-brake inspectors and repair men to attend, and extend courtesies to members from other roads. They are working solely in the interests of safer, better and cheaper maintenance of air-brakes for railroads. There is no possible gain to them, except to become experts in their line.

President C. C. Farmer has been particularly happy in his selection of men for committee work, each man is a wheel-horse on the subject given, they are as follows:

COMMITTEE ON INSTRUCTION.

F. M. Nellis, Westinghouse Air-Brake Co.
Paul Synnestvedt, Crane Air-Brake Co.
J. H. Hedendahl, Union Pacific Ry.
J. H. Cota, C. B. & Q. Ry.
H. B. Shreve, New York Air-Brake Co.

MAINTENANCE OF FREIGHT AND PASSENGER BRAKES.

P. J. Carney, Chicago & Northwestern Ry.
F. M. Nellis, Westinghouse Air-Brake Co.
H. W. Decker, Southern Pacific Ry.
W. F. Brodnax, Richmond & Danville Ry.
S. J. Kidder, Westinghouse Air-Brake Co.

AIR-PUMP REPAIRS.

A. Sanders, Missouri Pacific Ry.
Otto Best, N. C. & St. L. Ry.
H. Montgomery, Pennsylvania Ry.
W. H. Carr, P. C. C. & St. L. Ry.
Robert Wark, St. L. I. M. & S. Ry.
R. N. Martin, Pennsylvania Ry.

CLEANING OF TRIPLE VALVES AND BRAKE CYLINDERS.

R. Burgess, Westinghouse Air-Brake Co.
L. F. Houchin, L. N. A. & C. Ry.
J. B. Swan, P. C. C. & St. L. Ry.
M. E. McKee, Great Northern Ry.
A. Jessen, Louisville & Nashville Ry.

HANDLING TRAINS WHOLLY OR PARTIALLY EQUIPPED WITH AIR.

S. D. Hutchins.
Edward Fowler.
J. Brown.
C. B. Farmer.

SLID FLAT WHEELS.

C. B. Farmer.
J. L. Andrews.
Geo. Holmes.
C. B. Conger.
E. G. Desoe.

MAINTENANCE OF FREIGHT AND PASSENGER BRAKES.

P. J. Carney.
H. W. Decker.
W. J. Brodnax.
Ben Johnson.
F. M. Nellis.

There will also be short papers, as follows:

THE METHOD OF IMPROVING THE HANDLING OF PASSENGER TRAINS.

S. D. Hutchins.

DRIVER BRAKES.

Robert Burgess.

FOUNDATION BRAKES (CARS ONLY.)

L. P. Close.

SIGNAL EQUIPMENT—ITS TROUBLES AND REMEDIES.

W. M. Carr.

TENDER BRAKES.

J. L. Andrews.

THE BEST METHOD OF CARING FOR EQUALIZING DISCHARGE VALVE.

Otto Best.

AIR-PUMP GOVERNOR—ITS TROUBLES AND REMEDIES.

W. C. Walsh.

THE BEST MATERIAL FOR PACKING STUFFING BOXES TO AIR-PUMPS.

Henry Montgomery.

Every man employed on air-brakes in any capacity ought to become a member of this association. They can learn all particulars by addressing the secretary, P. J. Carney, South Kaukanna, Wis.

Loss to Coal in Storage.

The management of every railroad that stores large quantities of coal are aware that there is considerable loss from heating and slacking, but the men on the engines know better how serious this loss is and what poor stuff they are often asked to burn.

Probably no man has paid more attention to this subject than Mr. H. G. Belcher, of Los Angeles, Cal., who for ten years has had charge of thousands of tons of stored coal in a country where coal is worth in the neighborhood of $10 per ton.

Mr. Belcher has made many experiments with a view to saving coal and has succeeded admirably. His plan consists of means of ventilation at the right time and place. He has recently perfected a scheme of ventilating coal on shipboard that promises good results, but where coal is piled on the ground is where his improvements save the most money.

His plan consists principally of a large perforated sheet-iron pipe laid under the coal and filled with coke; this is connected with vertical piping, and for ships an interior and smaller pipe for removing heavy gases and forcing down carbonic acid gas to deprive fire of its life-giving qualities.

By using coke in the larger pipes a much lighter material can be used and the pipe is made to collapse for storage when not in use.

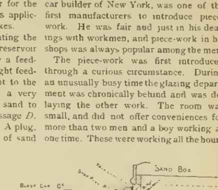
Leach's Improved Track-Sanding Apparatus for Locomotives.

The original form of this apparatus had no provision for sanding the track profusely in case of collision or other emergency, and was generally condemned on that account. In the improved apparatus the usual sand-lever is retained, and may be used whenever desirable.

By reference to the sketch, which shows one form of the device, it will be seen that the trap is bolted to the outside of the sandbox, where it may be readily got at for inspection and repairs. The trap receives its supply of sand through the independent passage *B* directly from the sandbox. By means of the air-blast through the nozzle *A* the sand is blown out of the trap through the passage *D*, which connects with the sand-pipe at *F*. It will be seen that the direct sand-valve *F* may be operated by the sand-lever in the usual manner.

Another, and by far the most common form of trap, is bolted to the sandbox lug in the same manner that the sand-pipe flange is usually attached. The lug is extended to provide two openings from the sandbox to the trap, one for direct sanding by means of the lever, and the other for the blast-feed. Either form of trap is applicable to old as well as new sandboxes.

The compressed air for operating the device is taken from the main reservoir connections, and is controlled by a feed-valve properly constructed for light feeding, placed in the cab convenient to the engineer. For ordinary feeding a very small amount of air causes the sand to "flow" upwardly through the passage *D*, and over the bridge of the trap. A plug, *p* 1, is provided, so that the flow of sand from the box may be stopped by a bit of waste placed in the passage *B*. The plug *p* 2 may then be taken out and the trap thoroughly cleaned of stones or other foreign substances. The cap *C* 1 receives the wear of the sand-blast and may be cheaply replaced when worn out. By removing this cap, access is had to the blast-nozzle *A*, which may be taken out with a small socket wrench provided for the purpose. The simplicity of construction and operation, and convenience for inspection and repairs, has been the cause of its remarkable success, about 1,600 engines being now equipped. Its utility is demonstrated by the fact that its use saves more than one-half the amount of sand used by the ordinary sand-lever arrangement. The waste of sand in itself is of little consequence. Pulling trains over an unnecessary quantity of sand on the rails is what wastes fuel, money, power, tires and rails.

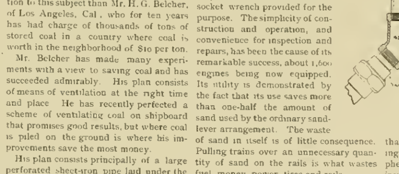


Leach Sand Feeder

The patent on this improvement was issued January 16, 1894, and is owned by Henry L. Leach, formerly M. M. of the Fitchburg, whose address is Room 45, Mason Building, 70 Kilby street, Boston, Mass.

Chain's Cylinder Spring Compressor.

The annexed engraving illustrates an apparatus which will be found of great service in facilitating the work of examining, cleaning and oiling brake cylinders. The device is a packing former and cylinder spring compressor. The cut shows the apparatus so plainly that no description is necessary. It is a very simple article, and one that will be certain to improve the condition of brakes when it comes into general use. Brakes frequently work badly because the cylinder wants oiling or cleaning or because the packing is out of order. With existing tools it is a tedious and laborious job to take the cylinder head off and then replace it with the strong spring to be compressed. The invention shown will make this labor light, and consequently it is likely to be done more regularly. The apparatus is the invention of E. E. Chain, Boston, and is handled by F. A. Barbey & Co., 215 Franklin street, same city.



Chain's Packing Former and Spring Compressor.

The second educational chart goes out with this paper. It's worth half the subscription price.

Where Piece-Work on Cars Was First Used.

The late John Stephenson, the noted car builder of New York, was one of the first manufacturers to introduce piece-work. He was fair and just in his dealings with workmen, and piece-work in his shops was always popular among the men.

The piece-work was first introduced through a curious circumstance. During an unusually busy time the glazing department was chronically behind and was delaying the other work. The room was small, and did not offer conveniences for more than two men and a boy working at one time. These were working all the hours that could be spared from eating and sleeping, but still the work was behind. Mr. Stephenson thought of making a larger glazing-room, but he was badly crowded for want of space, and it occurred to him that the men employed might turn out more work if he offered payment by the piece. He found out what the glazing of the various sashes cost, and offered to pay the men by piece-work on the same basis. This was accepted.

There was strong prejudice in the shop to the new innovation, but no active opposition was offered. After the new method was in use for a few weeks the head glazier discharged his assistant and did all the work himself with the assistance of the boy, and seldom worked any overtime while preparing the sashes as fast as they were needed.

This gave a good object lesson, which was applicable to other departments. The body painting room was badly in arrears with work, and interfered constantly with the prompt finish of cars. The men seemed to be working as hard as they could, and there was little prospect that piece-work could accelerate production. It was tried, however, and the force of men was found more than sufficient to do all the work promptly. One man who had learned his trade in the shop finished easily twice the work previously done. One of the men could never do better than his performance by the day.

The system was gradually extended to all other departments. It was found that on an average the men did about 30 per cent. more work under the piece system above what they did when working on day pay. In all departments men were found who could about double the average of the work done by the day, but others made very small increase of their own output, and were never up to the former average of the shop.

We have been obliged to scrap several communications because, for some cause or another, they have been long delayed—usually because they are not signed—until the matters they referred to are too old to re-open.

Practical Letters from Practical Men.

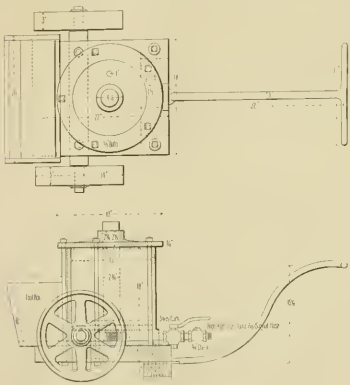
Facts Wanted. There's a glut of Opinions.

Write on one side of the paper, state your point plainly and briefly, and then quit. We supply the generalities. No letters noticed unless name and address accompany.

An Air Jack for Car Shop Use.

Editors:

I send you herewith a blue print showing the construction of a car jack operated by air for service in freight car repair shops. Our shops are provided with air-pipes for the purpose of testing air-brakes



Portable Air Jack for Car Shop.

on all cars, with hose connections 40 feet apart, and a pressure of 70 lbs. is maintained in these pipes. The same hose that is used to test the brakes is also used in operating this jack. Sixty pounds of air will raise an ordinary box car, and two men will place a car on horses and remove the trucks in 20 minutes, average time.

This jack is not our invention. We got the idea through the kindness of Mr. Wescott, Supt. Great Northern Shops at St. Cloud, Minn. We have improved on his jack, however, in some small matters.

As I have never seen any mention of a tool of this kind in print, I presume you can make use of it for the benefit of others in our line. It certainly will do its work a half quicker than any jack I have yet seen, and I presume nearly all repair shops are equipped with air-pipes for brake-testing, therefore this tool can be introduced cheaply.

S. L. Bean, M. M.

Brainerd, Minn.

The Steadiness of High Engines.

Editors:

The New York Central "999" class are acknowledged to be remarkably steady, although they are the highest engines at present running, I believe, with the exception of the new Pennsylvania "T" compounds, the center line of whose boilers is half an inch higher. It seems to be the general experience that high engines are steadier than low—on good tracks at any rate. Perhaps some of your readers can explain this apparent paradox.

Of course these high modern machines are very heavy, which would partially account for their superior steadiness, but I remember at least one instance in the old country where the running of a certain class of express engines was very much improved by raising their boilers 6 inches. Pending the scientific explanation, I will venture to offer this imperfect one: An engine is traveling on a perfectly horizontally level track, and eventually passes over a depression on the left hand rails. It will oscillate to the right. It then—still oscillating to the right—meets with a high place on the same rails. The tendency will be to stop this right hand oscillation and produce a contrary one to the left. The higher the boiler is, however, the greater leverage it will exert to resist this lifting power on the right hand side caused by the now compressed springs. Given a sufficiently high boiler, instead of being thrown over to the right the whole machine will be merely restored to the perpendicular. Here another perfect piece of track intervenes and the engine remains perpendicular. (I am supposing the boiler to be exactly the height, and the two irregularities in the track to be exactly sufficient to produce this result.)

Now suppose the boiler to be lower (and therefore exerting proportionately less leverage when out of the perpendicular), but all other conditions to remain the same. In this case, having tilted to the left at the depression, it meets the high place, the wheels rise, the springs are compressed and the power thus stored up in them is not only sufficient to restore the low boiler to the perpendicular but to throw it out of it and to the opposite side. Thus far, traveling over the same piece of track, the high engine has tilted to the right once and then become perpendicular, whilst the low engine has tilted to the right and left before becoming perpendicular. Repeat this performance *ad libitum*, and it is easy to see which would be the pleasantest foot-plate.

Abelene, Tex. Hugh Sharp.

Doc's Puzzles.

Editors:

I got a letter from my friend Doc the other day, giving some puzzles in the operation of the air-brake, copy of which is inclosed:

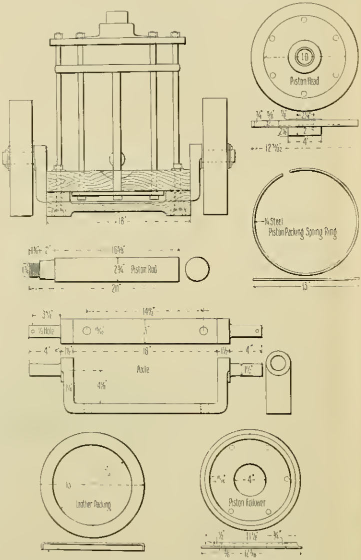
"Friend Conger—You seem to enjoy roasting me about my way of doing things. As long as you are so good-natured about it I won't kick, as I keep on learning a little. Billy and I went out on a special train yesterday. Like to lost my job over it. The air-brake wouldn't hold anything. A funeral party got left on No. 9 going to St. Louis, so they made up a special with one of the 16-inch engines that nobody has regular, a pony baggage car—same as box car—with platforms, and one of our big chair cars. We were handy to call, so they sent us out, being in a big hurry. The driver-brake would let off just about as quick as you could set it. We could hear the air whistle out through the triple-valve exhaust, so we were sure about that. The first stop we made brakes didn't hold good, so I went back to look the train over.

"The little baggage car had about two inches slack on every brake-shoe, so I took it up till the shoes just cleared the wheels. The big chair-car held pretty good, but every one of the shoes rubbed the wheels a little, so I let them out to about three-quarters of an inch all around, and thought it would help things, but next stop had to put her in back on sand for fifty or sixty car lengths. It was just that way all the way up. When we got there the car repairer let out the slack on the pony baggage car and took up the slack on the big coach; it held all right coming back. I watched him, and know nothing else was done to the cars. We made some new joints on the pipes to driver-brake cylinders, and that held all right coming back. When we got back to Indianapolis I had to walk on the carpet before the super. I expect he will give me thirty days for making poor stops.

"Now if you can tell me what was the matter, and what I did to spoil the brake, I would like to hear from you right away. Our air-brake instructor says the triple leaked through the graduating-valve, but we did nothing to the triple-valve and the brake held all right after stopping the leak. The brake-valve and pump on engine was in good order. The brake seemed to leak off on the baggage car, but the piston did not travel very far, so I know it did not strike the head. Help me out quick."

Now, Mr. Editor, please have the readers of Locomotive Engineering crack these nuts. Why did the brakes refuse to hold—remember, he don't say they did not work—after he had adjusted the slack to his liking? And, why did making tight joints stop the driver-brakes from letting go, though triple-valve exhaust if a leaky graduating-valve is the trouble? I know from experience that driver-brakes will let go that way when piston leather leaks, and when packing is made tight they hold all right.

Some months ago we had an engine with a 6 inch pump, on which it was impossible



Details of Portable Jack.

to get over 60 pounds of air at any time while working the brake. The machinist—so he reported—took down all pipes and said none of them was obstructed at any point. Another pump was put on with no better results. Joints were all tested with soap suds for leaks and no leaks discovered. Then we put the pailful of soap suds into the suction and run it all through the pump into main reservoir, and air pressure went up to 90 pounds, because the dirt and gum was soaked up and blown out of delivery-pipe, which was ½-inch and had lots of short bends and elbows in it. In about a week the same trouble began, only it was only 50 pounds this time. Upon making a careful examination a small safety-valve was found in main reservoir, out of sight behind brackets on deck casting and other hindrances to a clear view, that no one suspected was there. It was blowing off very quietly but getting in its work just the same. It was very promptly taken out and a gas-pipe plug that don't blow off put in its place. This pump is all right now.

Some of our equalizing discharge brake-valves fail to work as an equalizing valve, and D 17 hardly ever raises on a service application. When you examine them, look at the leather gasket first thing, and see if it is not leaking from train line into cavity over D 17. The valve acts very queer when there is a small leak there, some good air-brakemen have decided that the rotary valve leaked—and got left at it.

The 1892 model with feed-valve attachment has two gaskets in it, one of them, if defective, will let main reservoir pressure into this cavity and give the same trouble a leaky rotary valve does.

In Doc's case, it is a fact that slack of brake-shoes cannot be just alike on very light and very heavy cars, if they are braked for 90 per cent. of their weight with ...-inch cylinders.

C. B. Conger.

Grand Rapids, Mich.

Reminiscences of Pioneer Days.

Editors:

While reading your January number, I came across a question about the first locomotive used west of the Alleghanies. I can, perhaps, assist you in this regard. My parents moved from near Utica, N. Y., to Lockport about 1834 or '35. Col. Walbridge and some other capitalists built the Lockport & Niagara Falls R. R., and ran the same by horses for a year or more. I was but a kid then, but it being the first railroad that I ever saw it was a wonder to me. Two of my brothers were employed as teamsters, driving the horses from Lockport to the Falls. I have forgotten how many relays they had on the line, but one thing I shall never forget, and that was to see the amount one horse could pull on those rails.

After working about one year with horses they purchased a small locomotive with one pair of drivers, and it was named the "Pioneer." I think that I unloaded the same engine from a vessel at Vermilion, Ohio, and put it on the C. & T. R. R., northern division, many years afterward.

It must have been as early as 1835 that she was in Lockport. Mr. Charles Cooper had the care of her and ran her. Cooper went to Rochester, N. Y., and was there when I applied for a job on the Central road, or, as it was then called, the Rochester & Auburn R. R. This was in October, 1849. I went to Cleveland in April, 1850, and commenced work for Harback & Stone. These gentlemen had taken the contract to build the Cleveland & Columbus R. R., and as I was from the N. Y. Central I had no trouble in procuring a job.

The Sandusky & Mansfield was in operation before the Mad River R. R., for, in 1845, by brother and myself were boating between Cleveland and Pittsburgh, and the most of our freight was the old strap rail intended for the Sandusky & Mansfield R. R.

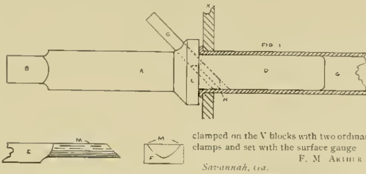
The "Pioneer" was the first locomotive that I ever saw. We moved to Rochester in 1837, we moved West in the fall of 1840, and returned to Rochester in 1846. After I learned my trade I started West, and landed in Milwaukee, took a locomotive on the C. M. & St. P., then called Watertown & Milwaukee R. R. Chas. W. Case, who, I see by your paper, has been appointed manager of the Great Northern, was my first fireman—that was in 1854. We were employed on the same road for nearly sixteen years. I frequently told the boys that I thought him capable of filling any position, and I find that I was not mistaken.

Los Angeles, Cal. A. J. Cole.

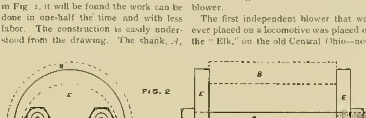
Some Handy Shop Tools.

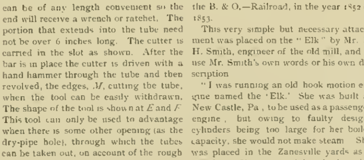
Editors:

It is often the case that the mechanic by the use of a little ingenuity is enabled to devise some special tool or method by which he can do his work more satisfactorily to himself and his employer. In many shops, however, there are no improved methods or appliances, partly because the workman thought it was not to his interest to improve on the methods of those before him, and partly, no doubt, the fault of those in authority. With a view of increasing the interest of mechanics in improved methods, I will describe a few special tools that I have found to be of great value in locomotive repair shops.



It is a trying and tedious task to cut out a set of tubes in the ordinary manner, by chipping. By the use of the cutter shown in Fig. 1, it will be found the work can be done in one-half the time and with less labor. The construction is easily understood from the drawing. The shank, *A*, can be of any length convenient so the end will receive a wrench or ratchet. The portion that extends into the tube need not be over 6 inches long. The cutter is carried in the slot as shown. After the bar is in place the cutter is driven with a hand hammer through the tube and then revolved, the edges, *M*, cutting the tube, when the tool can be easily withdrawn. The shape of the tool is shown at *E* and *F*. This tool can only be used to advantage when there is some other opening (as the dry-pipe hole), through which the tubes can be taken out, on account of the rough edge that is left on the tube.





In fitting up driving-box brasses considerable time is lost in chucking them. If a chuck similar to the one shown at Fig. 2 is used it will be found to expedite the work. It consists of two plates, holding the brass between them, securely clamped by the two bolts. The plates have centers drilled and countersunk to fit the centers of the lathe. It is driven by a bolt or L plate, secured to face plate. This chuck can be used on any lathe and is very convenient to clamp the brass. It will be found that two bolts will give better satisfaction than either three or one.

After the brass is turned it is generally taken to the slotter to be fitted to the box, where it must be lined and set square, the spring of the tool leaving sufficient taper to insure a fit. All this trouble can be avoided by doing the work on the planer and using the device shown in Fig. 3. This consists of two V blocks, with a tongue fitted to the groove in the planer bed and secured by two bolts. By slipping a piece of paper or tin under one of the blocks the necessary taper can be secured. This is preferable to planing one block lower than the other, as then they could not be used for other work without lining up. The brass is clamped on the V blocks with two ordinary clamps and set with the surface gauge.

F. M. Arthur.

Savannah, Ga.

Who Made the First Blower?

Editors:

It may be of interest to the readers of Locomotive Engineering to know who was the originator or inventor of the blower.

The first independent blower that was ever placed on a locomotive was placed on the "Elk," on the old Central Ohio—now the B. & O.—Railroad, in the year 1852 or 1853.

This very simple but necessary attachment was placed on the "Elk" by Mr. P. H. Smith, engineer of the old mill, and to use Mr. Smith's own words or his own description:

"I was running an old hook motion engine named the 'Elk.' She was built at New Castle, Pa., to be used as a passenger engine, but owing to faulty design, cylinders being too large for her boiler capacity, she would not make steam. She was placed in the Zanesville yards as a switcher. She was an eight-wheeler with 5½ feet drivers, and was a wood burner with big balloon stack.

"When the old girl did not boil her juice fast enough, we used to throw her out of gear, and with the starting bar move the valve enough so it would uncover the exhaust port, and by giving her a little throttle would give a good blast, which would soon run the steam pressure up. I put my thinking cap on one day, and thought why won't a jet of steam from a small pipe placed in the stack do the same thing. I went to Mr. Porsay, who was master mechanic, and told him my plans, and also to Mat Caldesh, foreman of roundhouse at Zanesville.

"I told Mr. Porsay we could hunt up some old pipe which lay around the shop, and with the assistance of a helper I could put it in myself and save the company any expense. So after my day's switching was done I went down to the shop after supper and found the necessary pipe. I did not tap the boiler, but just used the pump heater cock and connected my pipe to the heater cock on the boiler-head and run it out over the running board to the front end and up into the base of the stack, and it was done.

"The next morning when she was fired up for her day's work, the master mechanic and foreman and a number of the boys were down bright and early to see how the new blower worked. I can just see her now standing on the turn-table with the blower on, throwing the wood sparks out of that big balloon stack. I hardly need to say that it was a success. Soon after all the engines on the road were equipped with the blower."

Mr. Smith is now a resident of Columbus, O., having retired from railroad service after thirty-three years on a locomotive. He never had a collision nor was he ever called up on the carpet.

Columbus, O. E. H. Harmas.

[No doubt Mr. Smith's blower was original with him, but there is pretty good evidence that it was used before. Mr. Wilson Eddy built the "Addison Gilmore" at Springfield, Mass., during the year 1850 and put her into service early in 1851, and she had an independent blower such as are used now. Does any of our readers know of its use at an earlier date?]

Learning Sizes of Parts from Engravings —High Pressure in Train Pipe.

Editors:

I would like very much to shake hands with our friend Wood for the sentiments expressed in his contribution to the February number. Here is another who has gained more information from studying illustrations of the various air-brake parts and then endeavoring to make a practical use of the knowledge gained, than from any other method. I also find that if I am not quite certain as to the manner in which some portions of the brake operate, it is a very great help to take the engraving representing that part and make a sketch of it, say as large again, or one-half size and still keep the sketch in proportion—the measuring and transferring of sizes after this fashion will usually bring about the solution of the problem. Another point that is not, it seems, made use of as much as it should be, is that when a question arises, as sometimes it will, as to whether the standard size of a part has been changed, or a part has been lost where there is no duplicate, the catalogue engraving is the last place to get sizes from when it should be the first. For instance, main valve stop No. 50, Plate D 6, is broken off in a pump; engine needed and no extra stop, or size not known—the majority of air-brake repair men have often heard this kind of a story—suppose he goes to his catalogue and measures, say, the steam cylinder of Plate D 6, it is almost two inches in diameter, or not quite one-fourth the real size of cylinder; he then measures the stop, small end $\frac{1}{16}$ in., large end $\frac{3}{32}$ in. in diameter, length of large end of stop is $\frac{1}{8}$ in. full, therefore multiply these figures by 4 = small end ¼ inch, large end ⅜ inch, length ½ inch full, and as the engraving is a little less than one-quarter size, the extra quantity will give the extra $\frac{1}{16}$ inch for length of stop. By this means the stop could be nearly ready by the time the end of pin was removed. I believe every engraving of this sort should have its scale given.

Brother Alexander makes the point that with the new, or Plate D 5 brake-valve, 90 lbs. can be put in auxiliary reservoir, which is an advantage down heavy grades. It looks very much as though this was one of the least desirable [illegible] the valve, and one which is likely [illegible] to cause a great deal of trouble [illegible] a freight car loaded is only [illegible] with 70 per cent braking power, [illegible] weight it would hardly be practicable [illegible] risk sliding the drivers, and such other portions of the equipment as could not be [illegible] to correspond. While this valve is I believe a move in the right direction I have spent too much time trying to keep the main reservoir pressure from getting into train pipe "when it was not wanted" not to protest against overcharging the same purposely, and I too can advocate placing an air-gauge in every caboose equipped with air-brakes, along with a conductor's valve. This will not only educate the [illegible] crews by showing what effect fluctuations in the train pipe have on the brakes, but in case conductors are obliged to report [illegible] flat wheel it will no doubt [illegible] many engineers who are unjustly [illegible] as it will point out the ones that habitually overcharge their train pipe. While in very many cases, on account of faulty design in foundation brakes, or insufficient attention from inspectors, the wheels may not get their full allowance of braking power, these troubles are being gradually eliminated along with other impediments of like nature, and to countenance any variation from the recognized standard pressure is, according to the writer's ideas, a long step backward.

Will not the accuracy of Mr. Hazen's indicator depend very much on the condition of the equalizing piston?

Roanoke, Va. GEORGE HOLMES.

An Air Problem.

Editors:

Having applied a new pump to engine, I started pump to see if connections were all O. K. After pump had pumped up 35 pounds pressure, stopped it to fix slight leak in steam pipe to pump. After pump had been stopped about one minute, air whistle blew, and continued to do so at intervals of about a minute, until air was all gone. I examined signal line and connections and found O. K. After fixing leak in steam pipe restarted pump, and after attaining 60 pounds pressure opened drain cock to main reservoir. After draining reservoir, reclosed cock. Immediately after closing heard tank brake release. Then reopened cock and brakes applied; upon reclosing cock, brakes released as before. Pump still running. What was the cause? J. D. M[illegible].

[illegible], Kan.

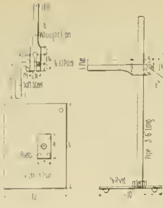
A Rule that Won't Work on All Kinds of Trains.

Editors:

In the January issue I notice an article from W. G. Wallace on "How to Tell if an Air is Coupled up," in which he states that by bringing the handle of engineer's valve from running position to full release the red hand will drop back about 1 pound for every car. This is all very good on short trains but not on long ones.

We will say that we are coupled to a train of *forty* cars and are carrying the handle of our engineer's valve in running position, and we have 70 pounds pressure on our train line and 90 pounds on our main drum. Now, according to W. G. W., if we bring our engineer's valve handle to full release the red hand should drop back about 1 pound for every car. Of course the red hand shows the main drum pressure, and the reduction of 40 pounds in main drum would be 20 pounds below train-line, which, according to instructions, would set the brake full force, and then we would be in lots of trouble. This rule will do up to about ten cars, but over that number it is a failure. This is from experience and observation. SAM. M. HUFFMAN.

Seymour, Ind.

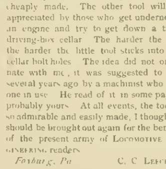


A Rod Rest and a Cellar Remover.

Editor:

I inclose herewith two sketches of tools that we find very useful in our shops. The rod rest is entirely my own idea, and is very handy for the men when filing brasses, and can be used in a variety of other ways, also. It is simple, and can be cheaply made. The other tool will be appreciated by those who get underneath an engine and try to get down a tight driving-box cellar. The harder the pull the harder the little tool sticks into the cellar bolt holes. The idea did not originate with me; it was suggested to me several years ago by a machinist who had one in use. He read of it in some paper, probably yours. At all events, the tool is so admirably made, and easily made, I thought it should be brought out again for the benefit of the present army of LOCOMOTIVE ENGINEERING readers.

Foxburg, Pa. C. C. LEECH.



Curing the Chatter of a Pump Governor.

Editors:

In "Diseases of the Air-Brake System, February number, Mr. Synnestvedt mentions troubles with pump governors whose steam pistons are not fitted with packing rings, and gives as the remedy to put in packing rings. A few years ago five new passenger engines came into service on the Vandalia Line and I fired one of them. Their pump governors were irregular in their action, and, when cutting off steam from the pump, would rattle and chatter so that the enginemen could not hear each other speak. The man I fired for screwed the regulating spring away down, and regulated his air pressure with the pump-throttle. He said that was best anyhow—had always done it that way. He never had a pump governor before, and didn't care whether it worked right or not. He would not use it nor report it. Really, it wouldn't have done any good if he had, for the other fellows reported theirs and the air-brake surgeon couldn't find anything wrong. And there wasn't. The governors were just as their makers intended them to be. It was a faulty design.

Finally, my engineer took a lay-off for the summer, and the runner in his place wanted to use that pump-governor. I asked the machinist at the other end of the road to fix it, and he said he would if I told him how, and I did.

The Westinghouse Plate D 9 pump governor, is so arranged that the steam-piston when at rest seats against the cylinder-cap above it, and the steam-valve at the lower end of the piston-stem does not come up far enough to seat itself, therefore, if the piston-stem fits loosely steam will escape continually through the waste-pipe and carry a considerable amount of oil with it, resulting in the pump groaning and working badly from lack of lubrication. The new governor is made so that the steam-valve seats both ways, above and below, so that but little steam is wasted but that is not the point.

With the older types of governor using the ringless steam piston, the piston was slightly tapered, its upper edge fitting closely in the cylinder and the lower edge narrower. When the piston was not cutting off steam from the pump it was seated against the cylinder-cap and slightly out of the bevel at the upper edge of the inside of cylinder. When running pressure accumulated in the train-pipe the diaphragm-valve would raise and the air pressure would push down the steam-piston, but not below the bevel in the cylinder. This made a large passage for the air around the edge of the piston and to the waste-pipe. The piston would immediately seat, and open and seat, and so on, continuously wasting air and rattling the governor to pieces.

We shortened the piston-stem so that at rest the valve would seat instead of the piston, and the piston would be pulled down in the cylinder far enough that the upper and wider edge of the piston would be below the bevel inside the top end of cylinder. That was three years ago, and the governor has given no trouble since. Finest working governor on the road, and it has no packing ring either.

WILL W. WOOD.

Terre Haute, Ind.

A Planer Chuck.

Editors:

In designing special tools in the modern railroad machine shop, where there is a tendency to do as much work as possible without the assistance of skilled labor, the tools must be made simple, so as to be easily understood, and strong, so as to be able to withstand a good deal of muscular effort.

One of the worst jobs, if not the worst, on a planer to strap down is shoes and wedges to plane the face after they have been laid out. The accuracy with which this is done is the saving of a great deal of time at the bench.

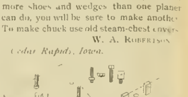
To secure this, the chuck here shown was designed; it consists of bed-plate, Fig. 1, 20x24 inches, into which three $1\frac{1}{2}$x$5\frac{1}{2}$-inch studs are screwed, and two holes are drilled to fasten to platen of planer; the studs are threaded their full length, except $\frac{3}{4}$ inch left to form shoulder to screw down on, and its nuts on each stud are faced on one side to a radius of three inches.

A plate, Fig. 2, with three holes to fit over studs $\frac{1}{4}$ inch loose, and concave to fit nuts on both sides. Drill and tap four holes to $\frac{3}{4}$-inch tap 11 inches between center lengthways and $7\frac{1}{4}$ inches sideways, to fit pieces $1\frac{1}{2}$ x $1\frac{1}{2}$ x $1\frac{1}{4}$ inches thick, that are drilled and tapped for set screws $\frac{5}{8}$ x $2\frac{1}{2}$ inch, cupped pointed. Get a wrench, and the chuck is ready for use.

To use, place bed-plate on platen of planer, and bolt fast. Place plate, Fig 2, on studs between nuts, then take shoe or wedge. If the face of shoe is thin, put between flanges two spread screws made from 1-inch hexagon iron, with $\frac{3}{4}$-inch bolt through center to keep the shoe from springing. Now place shoe between set screws and tighten up—it need not be so awful tight to carry a good heavy cut—then loosen top nuts, and with surface gauge on projecting part of bed-plate. Would say that this plate must be planed on both sides, and may be trued at any time when thought to be out. Screw lower nuts up or down until work is level with lines put there for that purpose; then tighten top nuts and try surface gauge again. The work is now ready to plane. After planing, the work can be taken off, tried on engine, and, if found not to be quite enough off, it can be put back in chuck and more taken off without resetting. Spot shoes and wedges top and bottom outside and at center inside, and put these marks opposite adjusting screws. This I consider to be one of the handiest tools that we have in the shop—we have two of them. Try one, and if you have more shoes and wedges than one planer can do, you will be sure to make another. To make chuck use old steam-chest covers.

W. A. ROBERTSON.

Cedar Rapids, Iowa.



How to Break a Water-Glass True.

Editor:

I will give your something I have found very handy, which I do not think is generally known, for cutting water and lubricator glasses. Take a parlor-match, one of the kind with red end, wet the brimstone slightly and mark the glass on the inside where you want it to break. Hold it over a torch or lamp flame. It will break off even where it is marked on the inside with match. G. D. HUTCHISON.

Ft. Madison, Iowa.

More About the Engineer's Valve with Reducing-Valve Attachment.

Editors:

In the February number I note the different articles relative to new brake-valve and my remarks on same in November number. Mr. Alexander evidently did not read my article correctly or he would have seen that I did not criticise the general construction of the new valve, only the reducing-valve attachment. In that article I stated, "Constructively, without the reducing-valve attachment, the new valve is a marked improvement over all the preceeding ones." I am in favor of the valve with feed-valve instead of reducing-valve attachment. Mr. Alexander seems to think that what is needed is brakemen who will open angle-cocks slowly. I am afraid he will have trouble getting this done as he describes, anyway it would not materially reduce the quantity of air required to charge the empty auxiliaries. He might release the brakes on twenty-five cars after picking up cars not charged, if only three or four were picked up; but if coupled to four or five and pick up fifteen or twenty, I think he would experience a little difficulty unless he had governor on main reservoir set to allow a very high pressure. In order to guard against delay in instances of this kind, with valve equipped with reducing device, I find it necessary to carry more excess pressure than is necessary to insure a prompt release of the brakes. This in itself is a detriment, in that it causes pump to heat. The friction of the air on itself in compression at 100 pounds is such that no compressor will run cool that is not water-lagged. Mr. Alexander also thinks, what I considered one of the bad features of reducing valve, an advantage, viz., that it is possible to maintain reservoir pressure in train line. He is like the man taking medicine, who thought if a spoonful dose would do good, by taking the whole bottleful at a dose would cure him. I would like to know what pressure is calculated in adjustment of brake-levers on his road. I would state for his information in regard to handling trains on mountain grades that we have lots of 3 and $3\frac{1}{2}$ and some 4 per cent. grades, but have never found it expedient to use 90 pounds air pressure in train line, and I still maintain that any device that makes it possible to carry excessive train line pressure will result in increased number of slid wheels.

Mr. Jenkins also claims a man can do anything with valve equipped with reducing device that can be done with one equipped with feed-valve, but does not say how, but rather seems to think I made light of amount of brake knowledge possessed by Santa Fé engineers in general. In reply, I will state that we have had all the advantages he describes. We have had traveling engineers from time to time; all engineers and firemen have been supplied with Westinghouse Instruction book, there is also a representative of the W. A. B. Co., who spends a good deal of his time on the system, and we have a set of engineers who, as manipulators of the air-brake, are the equal of those possessed by any railroad on earth. I will also state that I find some engineers who claim excess pressure cannot be carried on freight train, but have generally been able to convince any one that it can, though he may not act on the suggestions afterward. There are several reasons for men insisting on running with brake-valve in release position. With a leaky train they find they can maintain a braking pressure of 50 or 60 pounds where, if valve was carried in running position, only about 40 pounds could be maintained. Then, too, they claim, and truthfully, too, that their pump does not show the same tendency to heat as when carried in running position—this where governor is attached to train-pipe. On light trains, the excess pressure is not essential, and on any train with a careful manipulation of valve in service stops, no difficulty will be experienced in releasing brakes, but excess pressure should always be carried on long trains to provide means for releasing brakes promptly in case of emergency application or train parting.

I do not think that any man is built mentally so as to be impervious to education, although that is what perhaps is said by implication in the manufacture of the reducing-valve feature of new brake-valve. The kind of education you want is what will explain the why of these different appliances, explain to the men how it is that if train-pipe leaks had that brakes will creep on when brake-valve is moved to running position after having been left in release long enough to equalize train-line and main reservoir pressure.

Building a brake-valve with an attachment ostensibly to enable the engineer to carry brake-valve handle in running position and excess pressure, no matter how train leaks, but in reality is nothing more than equal to brake-valve in full release position (a good portion of the time at least), is not educating anybody, and will not make a good air-brake man out of a poor one.

I would say a few words for the benefit of Mr. Ellis, who puts the argument a little strong. I will make the assertion, and am ready to demonstrate it by actual test any time, that unless a leak develops that will let air escape faster than pump can compress it, that will carry handle of brake-valve of old two-way cock, D 8 valve or new valve *without* reducing valve attachment in running position, and won't stick or drag either, even though train-pipe leaks so cannot get over 20 pounds pressure, can have 40 pounds in main reservoir and maintain it there. Though I do not advocate starting with train in this condition. I will try and explain why this is possible. To begin with, you always have the same pressure on the train-line side of the valve as is on the reservoir side with brake-valve in running position, and any leak in train-line will draw direct on main reservoir. Say, for instance, feed-valve has spring with tension of 20 pounds, and you have 50 pounds in train-line, you will have 70 pounds in main reservoir. Train-line is the same, 50 pounds air plus tension of spring = 70 pounds, not all air but just the same pressure, and as soon as any leak starts in train-line feed-valve leaves its seat a little further and air passes direct from main reservoir to supply it, and will maintain an equality of pressure between train-line and reservoir at all times. To convince yourself, put handle of brake-valve in running position, open stop-cock on rear end of tank and start your air-pump, and note how much more pressure you get on main reservoir than equal to tension of feed-valve spring. All intelligent engineers ought to understand this, whether those referred to in full face type do or not I am unable to state. If not, and they will investigate a little they will change their minds. The reason that brakes set when brake-valve is moved to running position, after having equalized pressure in release position, is that pump is effectually shut off from train line until enough pressure has been accumulated in main reservoir to overcome tension of feed-valve spring. A little watchfulness is all that is necessary to overcome that. If brakes commence to drag, move handle to release position, not long enough to equalize pressure, but just to throw brakes off, then move to running position again. Except it is due to some defective triple, it takes a pretty bad leak to set any brakes, and sometimes when a man thinks brakes are dragging, if he will investigate he will find his imagination has got the best of him.

In the January number, Mr. Synnestvedt, in treating of hot-air pumps, cautions against the use of water taken internally. I would like if he would give his reasons why. I have frequently used water in pump when hot, and have always had good results. I went on the theory that if water-brake on mountain engine would prevent heating and consequent explosion, a little water would do the same thing for an air-pump. Heating in air-pumps is due chiefly to contraction of passages, and I find that water or soap-suds has a tendency to loosen gum. There may be a bad feature about this kind of treatment; if so, let us know what it is. Also in February number, in testing main reservoir for leaks, I think he should have said "Shut off air-pump, move brake-valve handle to lap," etc. It would have been a little plainer, perhaps, for those who take the instruction in a literal sense.

Newton, Kan. W. R. Scott.

A Chip from the "Whistler."

Editors:

Several years ago my father, G. H. Griggs, gave me a gold-headed cane that was presented to his father, G. S. Griggs, by the employés of the Boston & Providence R. R. On the head of the cane is an engraving of an old-time locomotive, under the engraving is written, "A chip from the Whistler."

My father told me that the body of cane was a piece of oak that used to form part of the frame of an old locomotive called the "Whistler." The end is a part of a stay bolt from the same locomotive. The cane was presented to G. S. Griggs in 1857. Any information that you will give me about the "Whistler," through your most interesting paper, Locomotive Engineering, will be appreciated.

A. L. Griggs.

Durango, Mexico.

[Not knowing the history of the "Whistler" very well, we referred this letter to Mr. Geo. Richards, of Boston, Mass., who was foreman for Geo. S. Griggs for many years, and succeeded him as master mechanic of the Boston & Providence road. Mr. Richards writes:

"The locomotive 'Whistler' was one of the first three locomotives in New England. They were built by Robert Stephenson & Co., Newcastle-on-Tyne, Eng., and received in 1834, one by the Boston & Providence, one by the Boston & Worcester, now a part of the B. & A., and the other by the Boston & Lowell. They had four wheels, two drivers on a crank axle, and two leading wheels. They had two eccentrics, secured to the shaft by spiral keys. In reversing, the eccentrics were moved laterally on the keys. The frames were made of two plates of iron, with a piece of English oak between them, all riveted through. It was of this wood that the cane was made.

"I well remember the presentation. The 'Whistler' was named for George W. Whistler, who was a prominent engineer, and had much to do with railroad building in this section of the country. Later he went to Russia, where he died. He was father of the artist Whistler."]

Give the Air-Drum Attention.

Editors:

After reading "Diseases of the Air-Brake System," by Paul Synnestvedt, the reader, if a practical man, must conclude that the author of the article must have been there and knows whereof he talks. He describes the diseases so minutely and applies the cures to heal every defect so completely that the practical reader will obtain valuable facts from Mr. Synnestvedt in his "Diseases and Cures of the Air-Brake System."

In my experience of over twenty years there is no part of the air-brake system that is so sadly neglected as the main drum. Every particle of air that is used in operating the brakes must pass through the main drum before any work can be done. This being the case, it is certain that the oil used in lubricating air end of air pump, dust and fine cinders pumped through valves, and the water accumulating must all be deposited in main drum. If these accumulations are not kept out of main drum they must pass through every part of the air-brake system on the train and interfere with their operation to a greater or less extent.

When air-brakes were not as well understood by those in charge as they are at the present time, I have known main drum to be neglected until the water would blow out of the exhaust-port in engineer's valve, and to-day, when air-brakes are fairly well understood, the neglect of the main drum on air-brakes on every railroad on this continent costs companies large sums of money yearly. Supposing every part of the air-brake system on a train of cars was cleaned and repaired, or put on new, excepting the main drum, which was one-third full of dirty oil and water, before one week's time the air-pump governor would be sticking, the equalizing-pressure piston in engineer's valve, the engineer's valve, and everything on the system would be affected more or less.

From my experience with air-brakes I have come to the conclusion that all main drums should be fitted with a cock in the lowest part, so that it can be opened by the engineer with little trouble. If the cock be opened at both ends of the road, and the main drum blown out with full pressure of air while the pump is working, the repairs needed to the whole of the air-brake system will be greatly reduced. This is an improvement which costs very little and brings surprisingly good returns.

A. McDuff.

Cedar Rapids, Ia.

How Much Pressure Should Be Carried with the New Brake-Valve?

Editors:

In the January number Mr. Holmes asks for opinions as to the pressure that should be carried in main reservoir when using the latest pattern of brake-valve, also refers to the preceding pattern of valve. The 20 pounds excess pressure carried when using the valve of 1890 (Plate D 8) is not sufficient to quickly release all brakes on a lengthy train after an emergency application, and if there are any considerable leaks in train line, will cause brakes to stick. The excess pressure valve may be adjusted to carry more reservoir pressure, but with the increased excess pressure some brakes on a long train will most certainly "stick" when the valve is drawn back to running position.

With the new valve of 1892 (Plate D 5) I think there may be no limit to the amount of main reservoir pressure carried. The feed of air through an inch opening from main reservoir to train-pipe is unrestricted until train-pipe pressure reaches 70 pounds, when the feed-valve closes. No healthy brakes will stick when train-pipe pressure is at 70 pounds. After the feed-valve closes, excess pressure begins to accumulate in main reservoir, and at the same time all waste or leakage from train line is automatically restored by the feed-valve, and as excess pressure will not accumulate until the normal pressure in train line is attained, there can be no sticking of brakes with this valve if enough pressure is carried in main reservoir. Now, what pressure should be carried? This is Mr. Holmes' question, and I can't understand why all the pressure the pump will make may not be carried to advantage.

Of course, if there is a high reservoir pressure and the valve is thrown into full release after a light application, there is danger of bursting a hose at head end of train, but it is unnecessary to use the full release position when the feed-valve has an inch opening.

Mr. Holmes calls attention to one of the extreme emergencies in air-brake service. Suppose you have thirty air brake cars; another section is following you closely with only a few cars of air and you run on to a flag. The first thing is to throw the brake full on—emergency—and exhaust all train-pipe pressure, it's the correct thing to do; but the flagman gets on, tells you "all right, let her go." No. 12 had a hot box—put in a brass—sent him back to flag and pulled out and left him. Your caboose is on the curve and the other fellows are coming; can you get your brakes off and get out of their way? You have no time to spare for bleeding auxiliaries. I don't think 90 pounds main reservoir pressure will do it. The Westinghouse people figure the contents of the train-pipe, hose-couplings, triple valve, etc., for the standard freight box car to be 819 cubic inches, and not counting the engine, the train-pipe of a thirty-car train would contain 24,570 cubic inches, while the main reservoir has a capacity of but 16,500 cubic inches of air. The head brakes would release and immediately begin to take air from train-pipe to recharge their auxiliaries, thus lessening the releasing pressure as it flows back from the main reservoir.

It is only a matter of time when all freight cars will be equipped with air-brakes, and they will all have to be used. And it's an absurdity to think they can be operated successfully without an enormous main reservoir pressure. There is no reason why an air-reservoir may not hold as great pressure as a steam boiler, or even greater. Some day the pump-governor will be abandoned and the pump run with full open throttle, the air passing to train-pipe through a large feed-valve as at present, the full release position of the brake-valve will be taken away in order to prevent the high pressure from rupturing hose or pipes, and a separate cock or valve attached to the brake-valve by which open communication may be obtained between the main reservoir and train-pipe in case of derangement of the feed-valve.

Will W. Wood.

Terre Haute, Ind.

[Instead of an excessive pressure in a comparatively small main drum, would it not be far better to employ much more reservoir space, thus supplying a greater *volume* of air instead of an excessive pressure? With a large volume to draw from the brakes would have to come off a long train, and the forward triples have all the air to supply their auxiliary drums they wanted.]

Clean Engines without Scouring—Some Road Talk by a Road Man.

Editors

In the Traveling Engineers Association and the "Air-brake Men" I look with eager interest to see a grand change and a wonderful improvement in the general care, handling, equipment and maintenance of locomotives, cars and air-brakes throughout the country. That a change in a good many of the railroads is needed, every intelligent and progressive engineer and fireman will candidly admit.

I believe that if more care would be taken in the selection and promotion of wipers to firemen, and of firemen to engineers, that where "strictly temperate" and intelligent men are employed and then carefully looked after by a traveling engineer who knows how to handle men mildly yet firmly—"Sternly yet tenderly, that he might feel the velvet scabbard held the sword of steel"—that in the majority of cases these same engineers and firemen can save their wages every trip by being very careful in the handling of supplies of all kinds, by working engine and water as fine as possible, by watching dampers to keep engine from popping, and by keeping everything in a neat and tidy condition. That an engine with all joints tight and a nicely packed cab, with everything at least thoroughly wiped, neat and ship-shape is worth more than one just the reverse, any one will admit. Why then are there so many engines in a filthy condition, with steam leaking through nearly every joint, air-pump running forty miles per hour and still making no air, pops blowing off steam when engine is standing or running shut off, and when pulling a train making scarcely steam enough to get over the hill." Is it the fault of the men who run or fire them that so many engines are in just this condition? In some few cases yes, but in the majority of cases no. It is as a rule simply because they have never been trained or educated up to any standard of excellence, and have naturally grown careless.

The engineer says the fireman is dirty and don't clean, when he never knew how himself, and consequently never showed the fireman how to even wipe off anything *right*, let alone clean. If the engineer don't know how to do these things, how is the fireman to learn? Only by employing men of first-class character and ability as "traveling engineers" to teach both how to do their work easily and promptly, and keep engines clean and *solid* without "living on them."

I fired a year and a half before I could wipe a lubricator off right (let alone scour brass), just because I was not shown properly, and I will guarantee that in that time I used more waste, more profanity, and worked harder than I did in the next four years, and with far less effect. I got on with a progressive engineer, in fact one of the smoothest men I ever fired for, and he told me to never mind the face of anything, just "saw out the corners, holes and pockets," and I could not miss the face. He was right, and I could soon do in minutes just what it took me hours to perform before.

There is no use of a fireman trying to clean an engine, however, if he is on with a man who is habitually dirty who only thinks of getting over the road, and who is always working water instead of steam. There is no reason why an engineer should not assist the fireman in keeping his engine clean, both by being neat himself and by once in a while helping him with his work. It is wonderful how much more interest a fireman will take in his work if the engineer will just encourage him once in a while by helping him clean up.

I have only been running six years, but I always help the fireman with his work, and in return, he assists me at anything I wish help at. I try to interest him in combustion, valve motion, air-brakes and time card, by short talks on the different subjects, and by actual experience by letting him run the engine, handle the air and make his own meeting points. By the way, it is *awful good* for a man's back to "take the scoop" once in a while.

Orders should always be read aloud to firemen for mutual benefit—may save a bad wreck sometime.

Engine crews, to be efficient in every class of service, should be the best of friends, and when they can't be should ask for a change at once, as the only way to render first-class service is to work for each other's interest and pull together.

When I speak of having engines neat and clean, I do not in all cases refer to "brass scouring," as there are a good many railroad systems that paint all brass work except the bell, and still have fine-looking engines. The Northern Pacific, generally conceded to be the best equipped road in the West, has all cab mountings and cocks on boiler head painted black, and a neater, tidier lot of engines would be hard to find, and the engineers and firemen as a rule are above the average in intelligence. The Northern Pacific has always kept an able force of traveling engineers, and the general efficiency of the men is due in a large degree to their efforts.

I believe that many well-managed systems can be made to pay better than ever before, if first-class traveling engineers and air instructors are employed to teach the men general economy.

All engines should be equipped with *port cocks*, and when oil is fed carefully to cylinders they will seldom gum up, and if they do, it is better to clean them out occasionally than to have soot and water thrown over front ends when taking them out of round-house. "An ounce of prevention is worth a pound of cure" is just as true on an engine as anywhere else.

There are two cocks in cab that should always be left with joints slightly broken, especially on engines with straight stacks, these are the throttles to blower and air-pump, or what is better, is to have them nicely ground in and then have a tiny steam-way cut in valves just enough to keep steam from condensing in pipes. The traveling engineers will improve engine service in all these and similar small details, as well as greater ones.

The air-brake men are going to instruct enginemen properly in the construction of air-brake apparatus and in the proper handling of the same, and will thereby vastly improve train service and prove the preventors of many a wreck, and will prove to companies yet in seeming ignorance, that it is poor policy to have a "thirteen-inch piston travel with a twelve-inch cylinder" to prevent brake-shoes from wearing out. I am glad to see that there is a general awakening to the fact that better braking can be done with short piston travel, and say sixty or sixty-five pounds pressure, than with a long travel and eighty pounds pressure, besides it is easier on equipment.

I feel certain that as soon as this all-around change and improvement is made, the ignorant taught and instructed, and the hopelessly bad engineers and firemen put at something else, there will be less grievances, less cuts, less wrecks, and more peace and harmony (besides far better service) between employers and employés than has ever been seen in the past.

L. D. Shaefner.

Anaconda, Mont.

Is Sixty Pounds of Air More than Sixty if Used on One Car?

Editors

The following notice is placed in the cab of all engines on this road:

F. E. & M. V. Ry.

NOTICE TO ALL ENGINEERS.

You will be very particular and not carry over sixty-five pounds of air at any time, and when pulling but three cars you will not carry over sixty pounds of air, and when pulling but two or less cars you will not carry over fifty pounds of air.

Great care must be exercised at all times in handling air so as not to slide the wheels. S. A. Teal, M. M.

Would like the air-brake experts' opinion in regard to this. Mr. Teal claims that 65 pounds of air, when handling one car, will slide the wheels quicker than when handling three or more cars.

I can't see how it is possible to get more power out of the same air pressure because there is only one car instead of several. J. W. Wirtz.

Missouri Valley, Ia.

About Oil Going from Lubricator to Chests.

Editors

Let me say the explanation generally given that the current of steam goes from the lubricator to the steam-chest is erroneous. The oil gets there simply and solely by gravitation.

The steam connection through the small tubes of the lubricator and the pipes leading to the steam-chest just causes the steam in that passage to equalize itself and there is no current, so the oil coming up out of the water finds but one outlet, and that is the oil-pipe to the cylinders, and that is carried down by its own weight. If you would place these same lubricators with the pipe slightly inclined upward, no oil would go to the place intended to be oiled until the pipe became filled with water. The oil is in just the same condition as if in the air. In air it would be surrounded by a pressure of 15 pounds per square inch at every point of its surface, and yet being pressed on all sides it follows the laws of gravity. The only difference is a larger amount of pressure.

C. O. Mikle.

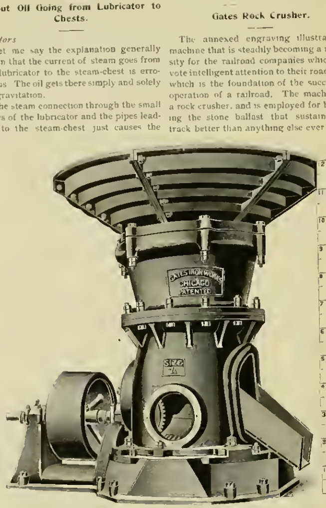
Huntington, W. Va.

Height of Drawbars.

At a meeting of the New York Railroad Club, attention was directed to the law concerning the height of drawbars for freight cars, and it appeared that those in charge of cars were not very clear about the provisions of the new law. An impression appears to prevail that the height now prescribed by the Interstate Commerce law is 33 inches, a variation of $1\frac{1}{2}$ inches above and below being permitted. This is, in fact, true, but the figures specified are that a car shall not have the center of drawbar more than $34\frac{1}{2}$ inches above the rail when the car is empty, nor less than $31\frac{1}{2}$ inches when the car is loaded. Some of the roads are changing the height of their cars to make the center of drawbar measure 34 inches from the rail when the car is light. This is $\frac{1}{2}$ inch lower than the limit, and there is danger that the car will be too low when loaded. If a car comes out of the shop set to a height of 34 inches when the springs are new, there is likely to be settling which will soon lose half an inch. We should advise all concerned to put the empty car to the high limit, for the tendency is to settle downward. The law calling for this change is very important, for it makes the railroad companies clearly responsible for injuries done to persons coupling cars with drawbars above or below the limit of variation.

Gates Rock Crusher.

The annexed engraving illustrates a machine that is steadily becoming a necessity for the railroad companies which devote intelligent attention to their road-bed which is the foundation of the successful operation of a railroad. The machine is a rock crusher, and is employed for breaking the stone ballast that sustains the track better than anything else ever tried.



Where fast, heavy trains are run no material short of stone ballast is satisfactory. It not only saves great expense in the maintenance of track, but makes traveling much pleasanter in summer owing to the absence of dust. The clean stone ballast employed has done much to enhance the popularity of the Pennsylvania Railroad as a passenger carrying route.

The machine shown is the most powerful in use, and crushes rock with surprising rapidity. It is a strong iron cylinder in which a conical fluted head is revolved by a heavy shaft. The rock passes down between the fluted head and the walls of the cylinder and get crushed by the contact. This machine will crush one hundred and fifty yards of stone an hour. Those who are using machines of this kind speak enthusiastically about their power, efficiency and durability.

This machine presents a formidable appearance. It stands 12 feet high, weighs about 32 tons, and its immense receiving hopper is 11 feet in diameter. When operating to its full capacity it requires about 125 horse power. Great strength has been given the crushing parts to make them available for the hardest hematite ore, trap rock, porphyry, and other rock and ores of well known hardness. The makers fully guarantee this machine to handle successfully any rock or ore known.

The machine is made by the Gates Iron Works, Chicago, Ill.

In France they call a dining car a wagon restaurant, and a sleeping car a bed wagon.

? A. What You Want to Know. ? A.

Don't ask questions that simply require a little figuring to determine; make each question separate. No notice taken of anonymous questions.

(26) M. J R., Henning, Minn., says:
Will you inform me how to solder copper wire to a zinc plate. *A.*—Good tinners' solder will do, with a flux of borax.

(27) W. L C., Jacksonville, Fla., asks:
Can a Westinghouse engineer's brake-valve be oiled whilst under pressure in case valve gets jammed and works hard? *A.*—No, not satisfactorily.

(28) J. T. B., Orion, Ill., asks:
What kind of an engine is the West Side Elevated Railroad of Chicago going to use? *A.*—This is not yet settled. The likelihood is that the road will be operated by electricity.

(29) J. D. H., Somerville, Mass., writes:
1. Does lead increase or decrease as lost motion grows? *A.*—The lead decreases. 2. Is lead beneficial or detrimental to a locomotive? *A.*—It is beneficial when used in moderation.

(30) Foreman, Hartford, Conn., says:
Can you give me an easy rule for finding out the weight of steel and iron castings? *A.*—An approximation of the weight may be found by measuring the castings. The average weight per cubic foot is 450 pounds.

(31) R. M., Pittsburgh, Pa., asks:
About what is the weight of a pair of cylinders and saddle complete for an 18-inch engine? *A.*—About 5,000 pounds. The weight of all the leading parts of a locomotive was given in our September number last year.

(32) W. Williams, Stuart, Ia., asks:
Why is it that in speaking of vacuum the word inches is used instead of pounds? *A.*—Because measurements relating to the pressure of the atmosphere are recorded according to the number of inches of mercury that the pressure will balance.

(33) J. F P., Chicago, asks:
What is the proper size for stay-bolts for a locomotive boiler carrying 180 pounds pressure? *A.*—Opinions differ. Some prefer stays as large as 1¼ inches, others think ⅞-inch stays closer together are better. We believe the latter is preferable.

(34) F. C. L., Horton, Kan., writes:
Were there any prizes awarded to locomotives at the World's Fair; and if there were, say on what particular points? *A.*—There were medals and certificates of merit awarded. The awards were based on various grounds—design, proportions, workmanship, etc.

(35) A Fireman, Fort Dodge, Ia., asks:
Referring to your description of the "Detroit Lubricator No. 2," would like to ask if there is any valve regulating the flow of steam between the equalizing tubes and the steam chests? If not, what is to hinder steam from moving engine? *A.*—The amount of steam used is so small and the condensing surface so large, that it is mostly water that gets through pipes.

(36) Engineer, Milwaukee, Wis., says:
The "James Toleman" has steamed badly and there is talk of sending to England for coal. Is the English coal better for steam-making than anything found in this country? *A.*—According to the tables in engineering books showing the constituents of different coals, some kinds of American coal are superior in heating qualities to anything found in Great Britain.

(37) R. H., Sherman, Texas, asks:
Tell me what caused all four eccentric straps to break on a Rogers ten-wheeler? Lubricator was working, engine had just been hooked up to make a run for a hill, engine had been out of the shop about thirty days. I asked my engineer the cause, but he did not give me any answer. *A.*—We surmise that your engineer was in something the same fix we are—we don't know.

(38) W. V., Detroit, Mich., writes:
What effect does it have on the forward motion to move back-up eccentric back half an inch? *A.*—It will make the valve open more slowly when the engine is linked up in forward motion. Advancing the back-up eccentric is sometimes resorted to as a means of increasing the speed of valve opening when hooked up in forward motion. Under some circumstances the latter change will make an engine smarter.

(39) A. M., Muscatine, Iowa, asks:
What was the fastest schedule of train known as the "Steamboat Train" between Boston and Fall River, and was there a sixty mile schedule anywhere in this country before 1894? *A.*—We have never heard of a faster schedule than one hour and twenty-five minutes for this run of 51 miles; the trains are very heavy, ten to fifteen cars. We know of no schedule time of sixty miles per hour, past or present.

(40) J. F. W., Terrel, Tex., writes:
Will you give dimensions of a calliope whistle for a locomotive? *A.*—A calliope is a musical instrument made of a stand of steam whistles, each producing a different note. We do not think that exact dimensions could be given. The Crosby Steam Gage Co., Boston, have made musical whistles and they could probably supply information required. We think that the tube of each whistle has to be adjusted to the required note.

(41) S. H. W., Youngstown, O., writes:
1. To settle a little argument, I wish to ask if the top of a locomotive wheel travels faster than the bottom? *A.*—Yes. If you examine the wheels of locomotives in photographs, taken while running, you will notice that the lower spokes are shown quite distinctly, while the top ones run into each other. 2. Is there any more weight on the rail when a locomotive is pulling hard than there is in pulling light? *A.*—No. The weight is constant.

(42) P. R., Rochester, N. Y., says:
We have had a dispute about the expansion of copper patches on steel fireboxes and some of us believe that copper expands so much more than steel that the patch works itself loose. Can you give us any figures about the expansion of different metals? *A.*—In the difference of temperature from the freezing to the boiling point copper expands $\frac{1}{581}$ of its length while steel expands $\frac{1}{811}$ of its length. Zinc expands in the same range of temperature $\frac{1}{340}$ of its length and platinum $\frac{1}{1131}$.

(43) C. C. M., Bennett, Pa., asks:
If the branch pipe be taken off an injector and another one put on which is much larger, will the injector throw water into the boiler? To show my meaning: Suppose I procure a branch pipe 6 inches in diameter, and attach it by suitable reducing apparatus to an injector and check of the size commonly used, will or will not the injector work, and why? *A.*—Yes, the enlarging of the pipe won't make any difference after it is once full of water. The injector simply supplies a water pressure in the pipe.

(44) W. A. K., Dartford, Ont., writes:
1. Suppose a traveler is able by the eye or ear to count the rail joints passed. If he counts the joints passed in twenty-one seconds will that indicate the number of miles per hour the train is running. *A.*—If the rails are 30 feet long, the number of joints passed in twenty-one seconds will give a close approximation to the speed in miles per hour. 2. What railroad in the United States has most mileage under control? *A.*—The Atchison, Topeka & Santa Fé. The other questions are not suited for our columns.

(45) W. H. S., Danville, Ill., writes:
I wish to know the best acids or composition to be used to write your name on tools; also the best covering to be used to protect the metal from the action of the acid. *A.*—The best corrosive compound for this purpose is a mixture of one ounce of nitric acid with one sixth of an ounce of hydrochloric acid. Cover the article to be marked with beeswax, write with a sharp steel scribe and apply the compound with a fine brush. Allow the compound to stand five minutes, then dip in water and clean thoroughly.

(46) Tool Room, Chicago, writes:
Can you tell me where I can get drawings or engravings of a metallic gland packing which can be made without infringing any patents? *A.*—We do not know where such drawings can be found, and we are not looking for them. The various forms of metallic packing on the market are sold at reasonable prices, and these ought to be used. Home-made articles got out to avoid infringement of patents generally do infringe, and it is only through the forbearance of the proprietors that pirates are so rarely called upon to pay damages.

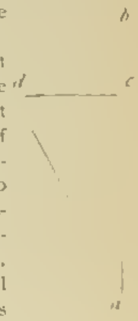
(47) W. H., Winnipeg, Man., writes:
1. If you lengthen the back-up eccentric rod ⅛ inch, would it make any difference to travel of valve when engine is in forward gear two notches from the center? *A.*—It would affect the travel slightly. 2. Train was coming into station and engineer put engineer's valve to service stop and brakes would not work. Piston 17 was not stuck. Put handle to emergency position and the brakes worked all right. What was the trouble? *A.*—We are afraid that if piston 17 was not stuck it worked mighty hard; possibly the preliminary exhaust port was stopped up.

(48) Apprentice, Columbus, O., asks:
What mechanical device is called a fusee, and what is it used for? *A.*—A fusee is a conical barrel round which a rope, chain or cord may be wound to equalize a pull of changing intensity. It was first employed for drawing water out of deep wells. When the whole weight of a long rope or chain was to be lifted, the coiling was done at the small end and consequently the work was slow. As the bucket rose the coiling got towards the thick part of the cone and the speed increased. The fusee is used on English watches and chronometers to regulate the pull as the mainspring gets run down. It is like a lever, constantly changing in length.

(49) R. C. B., Louisville, Ky., writes:
Can you give me a recipe for making a mixture which can be used to fill blow-holes in castings and as a cement for rough joints? *A.*—There is a cement made by the Otley Mfg. Co., of Chicago, which is very good for this purpose. A home-made cement, which we have seen highly recommended, is composed of five parts, by weight, of Paris white, five parts yellow ochre, ten parts of litharge, five parts red lead and four parts of black oxide of manganese. These ingredients are very thoroughly mixed, and when wanted for use a small quantity of asbestos and boiled oil is mixed with it. This composition will set in from two to four hours and is very little subject to expansion or contraction.

(50) B. L., Chattanooga, Tenn., asks:
1. What is the ordinary temperature of a locomotive smokebox and how is it found out? *A.*—The temperature varies from about 600° to 1,600° Fah. when the engine is working. The temperature is usually measured with a pyrometer which works by the expansion of metal. 2. In figuring heating surface, is it customary to take the inside or the outside surface of the flues? *A.*—The outside—that is, the side exposed to the water. 3. Is there any hard and fast rule for establishing the radius of a link? *A.*—No, when a designer is laying out a link motion he uses the radius of link which will serve best to adjust the steam distribution. It is generally drawn from the center of the driving axle, but sometimes it is made longer or shorter.

(51) W. J. S., Morristown, N. J., writes:
On page 36 of Auchincloss on "Link and Valve Motion," there is a travel scale in which the student is directed to extend a base line from *c* to some convenient point *a*, thus I am puzzled to know what determines the length of the base line. *A.*—The exact length of the base line is of no consequence. The triangle *d c a* is to be divided into parts by lines at equal distances apart, to show the extent of the valve travel, etc. The line *d c* is of established length, so the dividing lines will be the same, no matter how long or how short the line *c a* may be made. This can easily be demonstrated by experiment.



(52) H. C. S., Gladstone, N. J., asks:
Why is it that in plate D 26 special quick action triple valve (for six-wheeled truck), the stem in emergency piston 8 is hollow the entire length, and what the horizontal port shown directly underneath the piston-head is for? Also, explain the purpose of middle port in valve-seat. *A.*—Six-wheel truck brakes have a 14-inch cylinder, and, in order to make this release in the same length of time taken by a 10 inch car cylinder, there had to be a larger exhaust port, this was done by boring holes through the stem of the emergency-valve piston (8) and from them to the top of piston, this provides enough extra area to make the release uniform. The stem of emergency-valve (10) seats against and closes this top port, or hole, when the emergency piston is forced down.

(53) A. S. B., Toronto, Can., writes:
We are taught that the work of a horse is equal to 33,000 pounds raised one foot per minute. What I want to know is, how the work done by a man compares with the work of a horse? *A.*—The unit of work, called a horse power, is greater than the work accomplished by ordinary horses. It is reckoned that 22,000 foot-pounds is about the real capacity of a horse. Experiments made in England indicated that an ordinary laborer could perform work equal to the raising of 3,300 pounds one foot per minute, which is one-tenth of the standard horse power and nearly one-seventh of the actual capacity of a horse. Strong men are capable of doing considerably more work. In a measured test of strength an Irishman once raised in two minutes a load equivalent to 27,562 foot-pounds per minute, and an Englishman was second, exerting 24,255 foot-pounds per minute.

(54) C. McB., New York, asks:
Would a mechanical device for supplying oil to the journals of cars, a simple appliance which dispenses with the use of waste packing, be of commercial value? Would railroad companies take hold of such a thing readily? Do you think there is a demand for an invention of this kind? *A.*—Cars are oiled in a very crude and wasteful manner, but we are afraid that it would be difficult to introduce a mechanical lubricator for this purpose. Several appliances have been tried which carried the oil to the journals, but they were always destroyed by oil men ramming waste into the box. When this class of artists look into a box and see no waste in it, they do not stop to consider that some better conveyor of oil may be employed. They jam the box full of dope, and if anything is encountered which obstructs the entrance of the mixture, they punch it to pieces with the end of a pinch bar.

(55) J. H. L., Port Jervis, N. Y., writes:
1. Please explain which of the rails on a curve supports the most weight of a

train *A.*—Generally the outside rail, because the centrifugal force of the speed throws the train to the outside of the curve. If the outside rail is high and the train passing the curve slowly, the inside rail will bear the greater weight. 2. In a dispute A claims that the peripheral speed of a wheel is uniform, and B claims that the top moves faster than the bottom. Who is right? *A.*—The peripheral speed of the wheel is uniform, but in relation to an object on the ground the upper part of the wheel moves faster than the lower part. The upper part is advancing while the lower part is turning backward 3 is a silly question that a man with good sense ought to be ashamed to ask. 4 Explain how pressure on governor connected to train line is reduced after placing handle of engineer's valve in running or in lap position. *A.*—We don't understand this question. Air pressure on governor is same as train line; putting valve on lap will not change pressure on governor unless there is a leak in line.

(56) P W, Dennison, Ohio, asks

1. When an engine is running shut off, how does the air get to the cylinder behind the piston? This has reference to an old style engine, plain valve, and no relief valve. *A.*—When the piston starts back from the front head, the forward port is open and, as the piston recedes, it creates a partial vacuum in the front of cylinder, the port and the steam-chest This is what causes the sucking action on tallow cups; at the same time the piston is forcing any air there may be back of it out through the exhaust port and nozzle. When the piston has very nearly completed its backward stroke, the valve has moved ahead enough to open the exhaust to the front end of cylinder, and if there be a partial vacuum, then air will rush in to fill it from the nozzle, this movement of air is not very considerable, this is with the lever in corner. 2. In testing steam pipe and exhaust pipe joints, how does the water get into the exhaust? *A.*—We do not understand this question. If when testing with steam, the water that accumulates in the exhaust passages is meant, would say that it comes from condensation, and it is probable that the exhaust passages in the saddle are partly filled with water when engine is standing still, anyway.

A Mistake.

Last month a mistake was made in answering Question 22. This question was:

"Suppose you were waiting at a station for a train that does not stop, and this train passes one minute ahead of time by your watch, and your watch is 22 seconds slow, how much ahead of time is this train? I say 38 seconds, my friend says 1 minute 22 seconds. Who is right?" We said the train passed 1 minute 22 seconds ahead of time this was wrong A moment's thought will show that the train was one minute ahead *minus* 22 seconds, or 38 seconds ahead of time. We have received more than twenty letters about this question, some of them from general officers of railroads, all of which goes to show that this department is carefully read and thought of. We are obliged to our friends who thus help us out.

Starting Valve of Baldwin Compound.

Some time ago a correspondent asked us to publish description of starting valve gear of Baldwin compound. We misunderstood him, thinking he wanted the valve motion shown, and wrote him that we had already published it. He replied that he guessed the mechanics of the compound engine was too deep for some editors. We hasten to put ourselves straight with our correspondent—we got a boy to explain the starting valve to us We trust the following description will make matters plain:

The Baldwin combined starting valve and cylinder cock consists of a single casting, in which there are two taper plugs, one controlling the high-pressure cylinder cock and the steam for starting, the other controlling the low-pressure cylinder cock. The two plugs are held in place by springs and controlled by an arm operated by a lever in cab

The operation is as follows In position 1, the starting valve is open to admit live steam to the low-pressure cylinder, the cylinder cocks at the same time being open to the atmosphere. In position 2, all passages are closed, and at the same time live steam admitted into the low-pressure cylinder when needed to start a train; or, the cylinder cocks might be closed, the live steam cut off from the low-pressure cylinder, and the engine would be compounding in the most economical manner. The valve consisted of a cylinder having a connection to each end of the low-pressure cylinders, in which worked a plunger with three piston heads fitted with packing rings. These piston heads were so spaced that by a change of their position in the cylinders, the results described above were obtained.

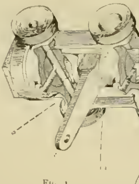


FIG. 1.

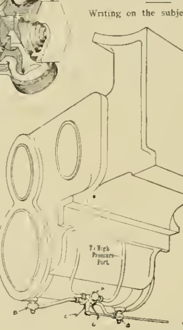


FIG 2

Compounding by Use of a Lap-Valve.

American locomotive designers ought to take the lead in making compounding a success in locomotives, for the locomotive had hardly attracted attention as an element in transportation when an American began experimenting to make use of the exhaust steam in a second cylinder. It was in connection with this idea that lap was first used on a slide valve. This was done by Mr William T. James, of New York, as early as 1832. It is now admitted that Mr. James invented and used the link motions on locomotives, which he built long before Williams of England designed what is known as the Stephenson link motion. The link was designed by Mr. James entirely for the purpose of reversing the engine It was an exceedingly simple form of reversing gear, and he appears to have had no conception of its capabilities as an expansion gear. He used a lap-valve to produce expansion, and tried to employ the lap to make a compound.

Mr. Dougherty, assistant to Mr. James, writing years ago about early locomotives, said "The lap-valve is older than the link by three or four years. It was one of Mr James' hobbies to use steam twice over in all his engines—that is, each engine had two cylinders, both of the same size, and the exhaust steam from the first cylinder was used in the second, the first cylinder having the lap-valve. By so using the steam there was a considerable saving over the single engine."

The principal thing which these views demonstrate is that any invention brought out to save steam or fuel is certain to appear to do so if it falls into the right hands. The information about steam engineering that has been acquired of late years proves that an engine using steam successively in two cylinders of the same size could not effect any economy, but this fact was not made clear in James' day, and he felt certain that his compound system had a great future The same misapprehension has arisen about many new appliances offered for use in engineering.

Some Early Steam-Brakes.

Writing on the subject of steam-brakes, Mr. George Richards, formerly superintendent of motive power of the Boston & Providence, said "Mr. G. S. Griggs commenced building locomotives at the B. & P. shops in 1845. He built in all 26 engines—all eight-wheelers with crank-axles.

"His steam-brake was arranged as follows An upright cylinder was placed over the boiler, a piston-rod ran out at the top, a cross-bar was attached to this rod, and on each side was a lever with a middle fulcrum, one end of each lever was attached by a link to the cross-bar, the other end of each forced down a rod, to which was attached a brake-shoe which bore partly on top and partly between the drivers. This brake was on two locomotives and worked well. It was discarded because it was ahead of the times.

"One of these locomotives exploded its boiler in the winter of '48-'49. After the scientific people had given the subject a prayerful consideration, they decided that the explosion was caused by the steam-driver brake. A few of us, on the inside, however, knew that the safety-valves were screwed down solid. There were no steam-gauges in use at that time

"Mr. Griggs also had a train-brake in use at that time, and applied the power to the wheels of the tender and all of the cars, and it was in use for a long time.

"I cannot tell when the brake was first used, probably early in 1848.

"In 1849, the time of the fastest train was one hour and fifteen minutes between Boston and Providence Now it is one hour, showing a gain of fifteen minutes in forty-five years."

A Wonderfully Designed Car.

The Iron Car Co.'s style of iron car, made of iron tubing fastened to malleable iron castings, was popular with many railroad men a few years ago, but it appears now to have fallen from favor without having proved unworthy. In his paper before the New York Railroad Club, Mr. G. R. Joughins seems to have vindicated this car. He says

"I have been looking at these cars nearly every day for the last three and a half years, and feel compelled to say that it is very seldom indeed that I have come across a structure in which the details are so well designed as the details of these cars. It appears to me that the draftsman was an artist in metal; he showed a profound knowledge of the art of designing malleable iron castings. Every detail of the car has been formed on the most correct theory, by some one who possessed an artistic eye, competent to combine beauty and strength, and who instinctively cut away every ounce of superfluous metal. I feel that I cannot too much admire the cunning of the hand which molded these different details and adapted them so perfectly to the strains which they are called upon to withstand."

Where They Work Piece-work With No Inspector.

A mechanic on a railroad running into Jersey City, N J., calls our attention to the beauties of piece-work without inspection as follows:

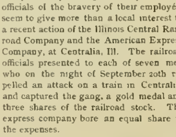
"Our paint shop turned out a caboose to-day as finished, with one brake-wheel and staff, one drawhead, one hand-rail, one side-stringer, one brake-beam, three oil boxes, the ends of two body bolsters and one spring unpainted, this was just the outside, can not say if inside was finished the same or not."

A Reward for Brave Services.

The increasing number of train robberies, and the advantage tending to public security in any recognition by railroad officials of the bravery of their employés, seem to give more than a local interest to a recent action of the Illinois Central Railroad Company and the American Express Company, at Centralia, Ill. The railroad officials presented to each of seven men who on the night of September 20th repelled an attack on a train in Centralia, and captured the gang, a gold medal and three shares of the railroad stock. The express company bore an equal share in the expenses.

A New Valve Handle.

The cut shown herewith illustrates a steam-valve handle, just put on the market by W. F. Green, of Troy, N. Y. The



body of the handle is made of malleable iron and the edge is wound with a steel spring; this gives a good hold for a greasy hand or glove, one that cools quickly and one not broken or coming loose like the flimsy wooden devices that have become the standard handle on cab fittings in this country. Something more substantial is needed.

Some Brains in Wheel Making.

By Camille Mazeaux.

ONCE upon a time, long years ago, some foreign admirer of the ingenious Yankee made this statement

"If you want to make a machine that can't be made, take it to a Yankee; he will *invent a way to make it, a machine to make it with*, and put on several improvements before you think he understands just what you want."

Pile of Scrap, Ready for Furnace.

This thought was brought home to me recently while visiting an American wheel works and noting the entirely original and unique way adopted to accomplish results, and produce what I unhesitatingly pronounce the very best and strongest wheel made for use under railway rolling stock.

In Europe we have from the first used nothing but wrought iron wheels, though our average load per wheel is far below that in America. Experiments and experience has proven that wrought iron is the strongest, most reliable, least liable to fracture, and the surest to yield to severe strains and recover itself again, of any of the metals used for wheels. Steel, though full of promises, has not been found any more honest, and is more deceitful than good cast-iron.

We use every known form of wrought wheel, the spoked form being the most generally used, but the ideal being the circumferentially corrugated web form, of which the No. 1, of the greatest German maker, is the best example.

Pair of Discs, After First Forging.

As is, perhaps, well-known, this great maker winds up a strip of iron for his center, and, while he gets results, we Frenchmen never liked the idea, and have tried for years to make a web of single plate from picked scrap, but have always failed to get a center that showed perfect welding in the interior. If the German ideal wheel would break out its hub under the testing machine, ours showed its weakness by laminations, that would virtually split the plate through the center, by repeated loads, in opposite directions, on the test press. So we contented ourselves with the spoked wheel and its thirty odd welds.

I naturally came to the conclusion that, as we have been experimenting for sixty years on wrought iron wheels, we should be in the van; and, as European railroad men always smile and say, "They use cast-iron wheels under everything over there," when speaking of America, I was somewhat surprised to find at the great fair some American made, single plate, wrought iron wheels, whose cut and etched sections showed perfect welding. I proposed then and there to find out how that was done—and I found out at the Boies Steel Wheel Works, in Scranton, in the province of Pennsylvania.

Our spoked wheels, with each weld made separately in an open fire, necessarily have many internal strains, and when put under the test machine invariably pull the spokes apart in the hub welds and not in the rim; this is undoubtedly due to the fact that the heavier parts are not brought to a welding heat through and through. How, then, could this American maker get a perfect weld of scrap in a hub six or seven inches long and eight or more in diameter?

At the Boies works the process was so short, direct and common-sense that I felt chagrined that none of my countrymen had thought of it in all their years of experience.

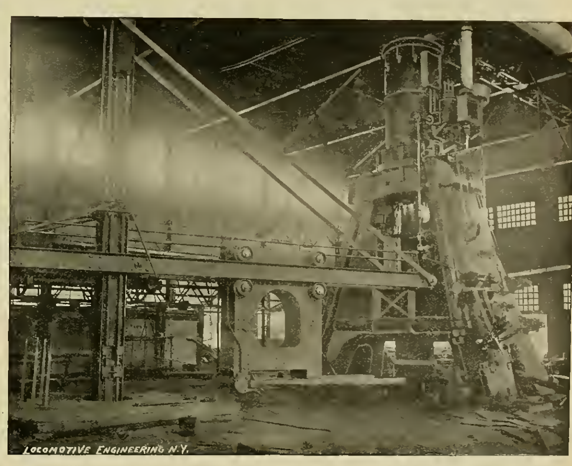
Front of Forged Center, Before Surplus Metal was Sheared Off.

Great care is exercised in the selection of the scrap, the man who shears this is a blacksmith, and he keeps a careful lookout for steel pieces. The scrap is cut about 14 inches long, and, in a pile for half a wheel, of say, 36 inches diameter, the metal is crossed over thirty times.

They pile selected and sheared scrap, and weigh each pile; they interlace the fibers in every direction, they heat in a gas furnace to the dripping point and then form, under their 20-ton hammer, a blank or disc. For the whole center? No; for *half* the center.

These discs are allowed to cool and are then inspected, to be sure that no blisters or imperfect welds occur. Care is taken to put in enough metal to make *more* than a wheel.

This insures perfect welding in each of the two blanks, but as they are thin they would cool enough between the furnace and the die to prevent a weld if heated singly. If laid together the outside would melt before the center was hot enough to weld—that's what spoils ours.



Furnaces, Hammer and Die Crane of the Boies Steel Wheel Works.

Here the Yankee comes in. His plates are nearly of a uniform thickness and will heat evenly, but there is little or no metal provided for the heavy hub, but he does the right thing at the right time, and around the center, and between the two discs, he places enough short pieces of faggot-bar to form the hub; these hold the two discs apart, the flames reach *every part* of each disc, and brings the two and the faggot bars up to the welding point at the same time—because all parts are of about the same size.

When they are at that beautiful white heat—not a dark spot in sight anywhere—a hand touches a hydraulic valve, the furnace door is lifted, a fork-hook is slipped under the almost melted pile, it is swung by an overhead trolly upon the die of the great hammer. Swish! and the giant smith of steam and steel has brought down his 20-ton sledge. There is a crash as if the hand had struck a roll of baker's dough, but before you can think that mighty hammer descends again and again, and you know without looking that there is a perfect weld and a perfect wheel center being made before your eyes—but why don't they stop that leaky steam pipe?

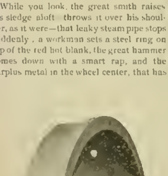
Back of Forged Center, After Surplus Metal was Sheared Off.

That steam has worried you, but the Yankee superintendent laughs as he shows you the two jets directed at the lower die—it's the way they get rid of the scale, such a smooth, clean face as it leaves. You can't help thinking of the water you have used, how it cooled the metal and increased

FRONT OF FINISHED CENTER, READY FOR TIRE

the scale, and made a noise—and still left the pock-marks. Then the salt, and the brooms, and all the other disappointing experiments you've tried, and left it for the Yankee to think of steam, that is quick, tears off the scale, don't cool the plate so much, and keeps comparatively still about it.

While you look, the great smith raises his sledge aloft throws it over his shoulder, as it were—that leaky steam pipe stops suddenly, a workman sets a steel ring on top of the red hot blank, the great hammer comes down with a smart rap, and the surplus metal in the wheel center, that has



BACK OF FINISHED CENTER, READY FOR TIRE

of necessity flowed over at the edges, is cut off.

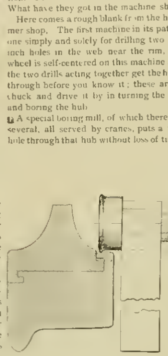
You understand now why they put in 25 or 30 pounds more of metal than they want; if there was just enough to fill the die, eight or ten blows would form the wheel center—they have struck between thirty and forty. No soft or spongy forging there. They have a simple standard for the amount of hammering they shall do, they hammer the fibers so close and firmly together that one of their centers cold will have a ring, when struck with a hammer, similar to that of a cast-iron wheel.

A boy touches a valve, and a little hydraulic ram, whose presence you have never suspected, comes up through the center of the lower die, and your red hot center is poised between the two dies, a fork-hook again receives it and it is dropped into an annealing pit in the floor, there to cool off at its leisure and take time to get rid of any internal strains it may have.

They show you the special crane for taking on and off dies—cost thousands of dollars, but saves time. Ah! just think of the men, and the time, and the delay, and the expense of changing those 6,500-pound dies as anybody else but a Yankee would change them. It's a grand forge shop, with its special tool for every operation. You have never seen its like before What have they got in the machine shop?

Here comes a rough blank from the hammer shop. The first machine in its path is one simply and solely for drilling two 1½-inch holes in the web near the rim, the wheel is self-centered on this machine and the two drills acting together get the holes through before you know it; these are to chuck and drive it by in turning the rim and boring the hub.

A special boring mill, of which there are several, all served by cranes, puts a true hole through that hub without loss of time,



TOOL FOR ROLLING INTEGRAL LOCK

it's off, and on the mill that turns the rims. Carefully it is watched here, special gauges, that allow for the heat generated by the work, are being used by each workman, and as he finishes an operation he puts his private stamp on it

Finally the rim is turned, that inside lip, like a Mansell retaining ring, is finished to a gauge and the wheel is placed on the floor, then the foreman tries *his* gauge and places his mark of approval in the metal.

Every time they have bored a hole or turned a shaving you have looked for that black line that denotes a bad weld, but you haven't found it—it's not there.

Over in a corner is a great press capable of exerting a pressure of 200 tons. It used to be used in the manufacture of this maker's built-up wheel, but he, and you, and I all know that the day of the built-up wheel is on the wane

On this press the wheel is placed, and from the tire shop comes a tire bored to gauge for this size and heated to expand it. Down it goes over the center and the ram comes down on it—just to be sure it's home solid and the lock is firmly embedded—a jet of water cools it down, and gauges will show you that the center has sprung and become smaller in receiving it, and then you know that when that tire gets warm from the use of brakes the center will spring back and keep the tire tight even then.

While you were thinking, a crane has taken your wheel away and it is being placed on a mandrel and centered on a wheel lathe Here a tool with a roller on its side is placed on each side of the wheel, the machine having tool posts each side, and the first deliberate job you have seen is being done. These rollers swage home that lip on the tire that the maker calls an integral lock The wheel is revolved with a rim speed of only 12 feet per minute, and the rollers are advanced but 1/64 of an inch per revolution; it takes an hour to set out this ring This is done so as not to start the grain of the steel and thus separate and weaken it That 200-ton press can't get one of these tires off with this one ring and the shrinkage holding it By the way, the standard shrinkage used here as elsewhere in America is 1/16 of an inch per foot of diameter. Your wheel is now ready for paint—and service.

But you are interested in a lot of odd wheel centers—all kinds and sizes. They are old centers that have been tested in this great press, all of them have met their Waterloo except one, and that is one of these very centers you have seen forged. It has a permanent set in it of ¼ of an inch and when you are shown the record you wonder why it isn't ¾ of a foot, for, supported at

CROSS SECTION OF BOIES WHEEL COMPLETE.

four points on the rim, it has stood *thirty blows of two hundred tons each* on that press Then you stop wondering what kind of a wreck could injure that wheel

Such wheel centers are a permanent investment for a railroad, they never wear out, they are immensely strong, they must be absolutely safe. How, with such magnificent equipment at hand, the American roads can afford to use cast iron or built-up wheels under their ponderous equipment is more than a French engineer can understand.

In our country, in case of accident, the courts would make it very, very interesting to the road that had a proven inferior device in use when a better could be had—and this will come in America

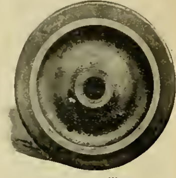
This maker will put on Mansell retaining clips if you want, or the Gibson fastening, but after you see the integral lock you don't want any of them.

He has a perfect wheel with the smallest possible number of parts—two. A wheel of one metal throughout, tire and center, cannot be a success, the requirements of service being far different, and the wearing out of a tire would then mean the loss of an expensive center.

If the carriage superintendents and locomotive engineers of America could see all the different wheels made, I don't believe there's one that would leave the Boies works without the same conviction that I had—that he had seen the best possible wheel made in the best known way.

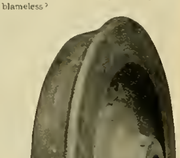
Safety from Wheel Accidents.

Wheels that have to be re-tired by taking out bolts and perhaps moving plates have inherent weaknesses that must



BACK OF TIRED WHEEL

grow with age Human ingenuity has not yet produced bolts and holes that can remain long perfect fits under such loads and strains as a car wheel gets in service. Every extra piece in a wheel makes it that much more liable to derangement. The Boies wheel is composed of but two pieces, the center and the tire—the fewest possible No bolts to work loose, shear or enlarge the holes No wheel to take apart in re-tiring A wheel that can be re-tired without touching the center—all fastening being done by the tire. A center stronger than required in any service—as permanent an investment as the right of way. Gives the mechanical department a chance to select any make of tires, and guarantees absolute safety against accidents from wheel failure of any possible kind. Can you afford to take chances on your passenger equipment with wheels that can, do, and have failed? In case of a fatal wreck from wheel failure could you hold yourself blameless?



THE BOIES WHEEL, READY FOR SERVICE

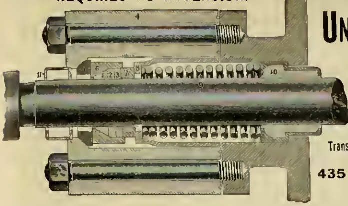
Deceptive Tire Fastenings.

Car repairers and others who inspect and have charge of passenger equipment should not forget to take into consideration the kind of fastening used on tires when noting their thickness.

Any wheel with Mansell retaining-rings has a thicker tire by half inch than appears —the rings cover up that much tire. This is also true of the Allen and Paige wheels

The Boies No. 2 wheel having the integral lock appears to have an inch more tire than it really has—the outer lip coming down over the wheel center. This is true also in slighter degree with other wheels.

REQUIRES NO ATTENTION.



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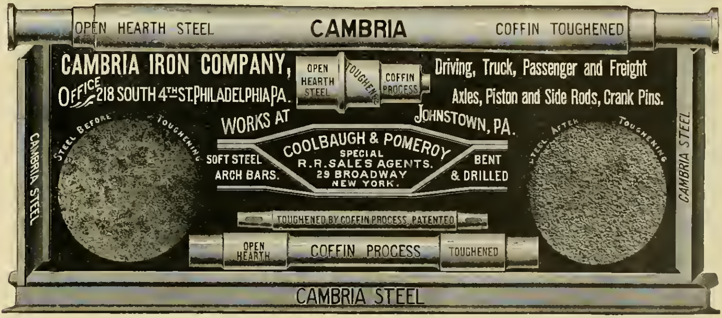

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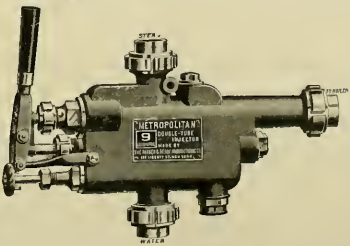
They are not affected by leaky steam or check valves.



Owing to the peculiar form of nozzles used, repairs of these Injectors are reduced to a minimum. They are very slightly affected by bad water, there being no small relief holes or spills to wear or become clogged.

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Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock.

VOL. VII, No. 4. NEW YORK, APRIL, 1894. 20 Cts. Monthly $2.00 Per Year.

Mountain Climbing.

American locomotives were the first to gain reputation as hill climbers. The early English idea about a locomotive was that it must be run on a fairly level road to show favorable performance, and so immense labor was expended in cutting down hills and in filling up valleys to make a level road-bed. There was a belief that smooth wheel locomotives could not be employed in climbing steep grades, and no attempt appears to have been made to test how far this theory was correct until American engineers took it up.

In 1836 a Norris engine, designed by Mr Joseph Harrison, was tried on the Columbia Railroad, now a part of the Pennsylvania Railroad, on a grade of 369 feet to the mile, and it pulled a little more than its own weight a distance of 2,800 feet at the rate of 15 miles an hour. Owing to the fame of this feat, a Norris engine was shortly afterwards imported to England to pull trains up steep grades on the Birmingham & Gloucester Railway, which English engines had failed to ascend without a load.

An account recently published in the *Anglo-Brazilian Times*, indicates that American locomotives are still attaining new triumphs in mountain climbing, and that abroad they are throwing in the shade the amazing performances of locomotives on some of the steep gradients on Rocky Mountain railroads. Think of an engine with smooth wheels climbing a grade that rises 9 feet in every hundred. We quote from the Brazilian paper

"One of the three Baldwin locomotives recently obtained by the province of Rio de Janeiro for the serra section of the Cantagallo Railway having been set up and got ready for service, Dr. Honorio Bicalho, Director-General of Public Works, of the Ministry of Agriculture, and a number of other engineers, went on the 17th inst to Cachoeira to attend a trial of the new engine, made by the administration of the Cantagallo Railway, to test its fulfillment of the contract engagement to draw a 40-ton train up gradients of 8 3 per cent. This was successfully effected, the locomotive, weighing 40½ tons when ready for the trip, drawing a train of 40 tons, composed of three trucks, laden with sleepers, and a passenger car, drawing it from Cachoeira to Boca do Mato, 8 kilometers, at the speed of 24 kilometers an hour, and then easily up a rise of 8.5 per cent., with curve and counter-curve of 40 meters radius, a result superior to the contract engagement, and it is believed that when the driver has become familiar with the engine it will as easily ascend rises of 9 per cent.

"It has thus been satisfactorily proved that the serra section of the Cantagallo Railway can be worked with engines without special adherence, and that the Fell system adopted for it, and worked at such serious expense, can be completely dispensed with, as will be as soon as the Barlow rails have been replaced by steel ones on the remainder of the serra section, and also on the first section, reducing the gauge of the latter to that of the rest of the railway. With these improvements it is expected that the working expense of the Cantagallo Railway will be so largely reduced that, instead of a burden, it will become a source of profit to the provincial treasury."

Brazilian engineers called the grades 8.3 per cent., but measurements were afterwards made by American engineers and it was found that the gradients were steeper than 9 per cent., and that curves of about 20 degrees twisted the trains on the heaviest part of the climb.

The Contributory Negligence Infamy.

In a published address by the Hon L. S. Coffin, of Iowa, we find the following sensible remarks about an infamous law

"Here is an intended passenger. It is not absolutely necessary that he should take the train. He knows that accidents do happen to trains. He knows that the dispatcher in yonder office *may* make a mistake and send his train crashing into another. He knows all this, but still he takes the train; but does the court hold him as contributing to the results of the collision that cost him his life? Does it hold that he assumed the risk and therefore cannot recover? On the other hand here is a green, simple boy, infatuated with a desire to be a trainman. You and I and all the great public and the court judges even want him, green as he is, to become a railroad employé because somebody must run the train. We want to ride, we want to send and receive our goods. It is absolutely necessary that this boy, unsophisticated and rustic as he is, having hardly the slightest idea of what railroading is, knowing nothing really of its perils, but desiring to follow this as his life work, and in so doing will be a great benefit to us all, to stockholders and to all, he goes, and in attempting to couple the first car perhaps is killed. Parents seek to recover something, but the judge whose library was in the car that killed the boy decides that as the boy was supposed to know all the dangers of railroading he assumed the risks, and by trying to do what we all wanted him to do; what the judge wanted him to do so he could get his package of law books; doing what the poor boy was in a sense *compelled* to do to earn his bread, doing his part in carrying on that which is now become a necessity of our civilization, because he did this he contributed by his own negligence to his death, and therefore the parents of the boy cannot recover.

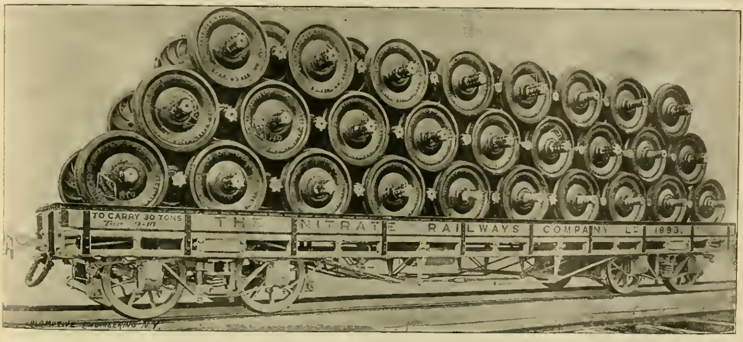
"What, we common people ask, are our laws and our courts for? Are they for the strong or for the weak?

"Let the courts hold the roads to as rigid responsibility for the life of the employé as for the passenger, and it would be the most effectual safety appliance possible It would then be only a question of short time when every car would be equipped with automatic couplers and every train with power brakes. Then this dark, foul blot on this otherwise grandest achievement of this nineteenth century would be washed away."

Take another case The company for some reason employs a dispatcher He proves incompetent, he gets drunk, in his maudlin stupidity he sends two trains together and lives of trainmen are sacrificed, and others are crippled for life. "Cannot recover because it was caused by negligence of fellow employé." Did the dead men have any voice in employing the incompetent dispatcher?

The Committee of the Master Car Builders' Association having in hand the investigation of brake beams has sent out a circular containing sixteen questions calling for information. The chairman of the committee is Mr. E. D. Nelson, superintendent of motive power of the Pennsylvania railroad at Williamsport.

The subject of "Wheel and Flange Gauges" is under investigation by Mr. J. N. Barr, chairman of a committee appointed by the Master Car Builders' Association. There is such a variety of gauges of this character in use that it is very desirable that the best ones should be selected and recommended.



American Iron Car Built in England Church & Ettinger's Patent Trucks Length, 34 Feet. Light Weight, 21,280 Pounds. Load, 85,170 Pounds Deflection under Load, $\frac{1}{16}$-inch.

*Diseases of the Air Brake System; Their Causes, Symptoms and Cure.

By PAUL SYNNESTVEDT.

Train-Pipe.

In speaking of the train-pipe we include all the piping which serves to carry the air from the engineer's valve to the triple-valve throughout the train. *Not* the pipe that carries the air from the triple-valve to the cylinder, as that must properly be regarded as a part of the cylinder. Of course, the hose connections form a part of the train-pipe, as do also the branch pipes leading from the train-pipe to the triple-valves, and on passenger trains the small length of pipe leading to the conductor's valve.

The two great difficulties that arise in the train-pipe are leakage and stoppage,

PLATE 16 A.

both of which, but the latter particularly, may be productive of the most serious consequences.

LEAKAGE.

Leakage may most readily be detected by a continued falling of the black pointer on the gauge when the engineer's valve is placed on the lap, and the rapidity of the reduction will show the extent of the leak.

A very heavy leak will make it difficult, or, in some cases impossible, to maintain sufficient pressure in the train to properly operate the brakes, while a slight leak will sometimes cause a sticking of the brakes, though serious trouble from this cause may be prevented on the road if the pump be in good condition and the brakes carefully handled, as the constant feeding of

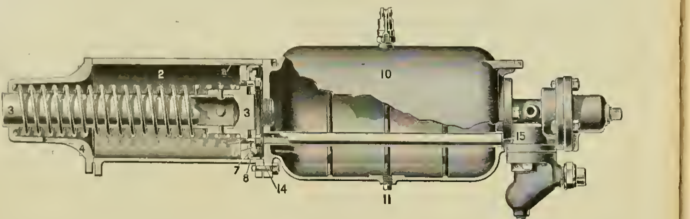


PLATE 18 A.

pressure back from the engine will overcome the loss. Slight leakage on trains running on mountain grades is more serious, because it results in a constant increase of the braking force when it is not wanted.

LOCATING LEAKS.

If the engine gauge shows a leak in the train-pipe a careful examination of the following points should be made, as they are the places where it is most likely to occur: Hose couplings, hose, pipe unions under the tender, conductor's valves, and the T at which the conductor's valve branch pipe is connected to the main pipe. A bleeding cock left open on any auxiliary reservoir or a triple-valve blowing from the exhaust will also show as a leak in the train-pipe (that is, by a reduction or falling of the black pointer on the gauge). These cases, however, are very easy to find, because they make a very decided and audible blow at one point.

The T connection, where the conductor's valve branch pipe is connected to the main train-pipe, is particularly mentioned because that is a joint frequently broken by pulling cars apart *without uncoupling the hose.*

LEAKAGE IN COUPLINGS.

Perhaps the most frequent cause of leakage is to be found in the hose couplings, generally from some defect in the rubber packing ring. A leak at this point should be treated as follows: First uncouple the hose, examine the packing rubber, straighten it if it seems bent or twisted, and couple up again. If this does not help, and there is not time to replace the hose or packing rubber, take a little nail or wooden wedge and drive it in between the lugs on the coupling in such a way as to force the packing rubbers closer together in the position indicated at 2 in plate 16 A. A very bad leak may sometimes be entirely stopped in this way. Never strike the lugs on the coupling so as to make it go together more tightly, as this makes it difficult to couple to a coupling which has a new rubber in it, and also increases the liability of rupturing the hose in case the train pulls apart.

BURST HOSE.

About the only remedy for hose which are burst or leaking is to replace them with good ones. If no extra ones are to be had one can be taken off from a car near the rear of the train, say the last hose on the last car.

LEAKS UNDER TENDER.

The pipe unions under the tender are a frequent cause of leakage, probably because of the conditions surrounding them. Engineers should be very careful to thoroughly examine the equipment on their engines before condemning the train crew for not stopping leaks which may be bothering them. It may be nothing more than a rotten gasket in one of these unions or a loosening of the nut because the pipe had been insecurely fastened and rattles. Too much emphasis cannot be put upon the desirability of having all air-brake pipes very securely and firmly fixed in place. This will prevent a great deal of trouble.

LEAKAGE IN CONDUCTOR'S VALVES.

Conductor's valves sometimes get to leaking because of dirt lodging in them. Sometimes (and always with the new style) they do not close after having been opened, and although the blow from such a one be heavy it may be hard to find, because the location of the valve in the closet renders it rather inaccessible.

STOPPAGE, I. E., OBSTRUCTION.

Now we come to the consideration of

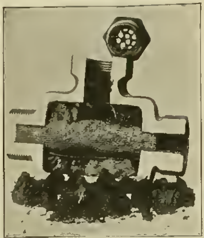


PLATE 16 B.

the second part under this head - stoppage. By this we refer to any obstruction which interferes with the passage of air through the pipe. This difficulty is always manifested by a refusal of the brakes to set or release properly *back of a certain point* in the train, while all those forward of that point operate satisfactorily. Sometimes the stoppage is of such a nature as to allow the air to pass freely through the pipe in one direction but not in the other, the obstruction closing the pipe just like a valve.

It will be very readily seen that this is a very dangerous disease and may result in the death of the patient (total failure of the brakes at a critical time), if it is not very promptly treated and cured.

Of course, the closing of a hose-cock somewhere in the train is the most frequent form of this trouble and great care must be taken at all times to see that this does not occur, or if it does happen, to have it immediately located and remedied. Hose-cocks will sometimes close while running if they stand in such a way as to strike against one of the timbers above the handle.

TESTING BRAKES.

The engineer can make a very close approximate test of the number of cars cut in from the engine back while he is running as well as when the train is at rest, without in any way interfering with the speed or momentum of his train, by simply moving his engineer's valve handle from the running to the release position after his main drum has accumulated 20 pounds of excess pressure (red pointer 20 pounds higher than the black one), and carefully noting the number of pounds that the red pointer falls during the first couple of seconds. For ten average freight cars it will fall about 10 pounds. For twenty cars or over it will fall from 15 to 18 pounds. If the train is cut out one or two cars back of the engine the reduction will be but a couple of pounds. This result will, of course, vary slightly with leakage, the size of the drum, and the length of the cars, but a little practice will enable any-one to make a very close guess.

If the obstruction in the pipe is of such a nature that it permits the passage of air in one direction but not in the other, it is apt to be still more dangerous. This has been known to occur through a curling up of the inside lining of the hose, the rubber rolling up into a ball, and, just like a valve, opening one way and closing the other. It might also be caused by the cylindrical screen in the car drain-cup collapsing or clogging up with the dirt. Plate 16 B, taken from the *Railway Age*, shows one that was in the possession of Mr. G. W. Rhodes. It is a fair sample of many that are now in service.

Cases are also recorded where ice has formed in the coupling or hose sufficient to obstruct the passage. This often results from allowing the hose to bang down and drag through the snow, and afterward coupling it without examination.

Auxiliary Reservoir.

It is not generally supposed that anything ever goes wrong with the auxiliary reservoir, as it is nothing but a storage tank for air.

It plays a very important part, however, in the action of the triple-valve, and any leakage here, even though very slight, may seriously interfere with the functions of the most vital mechanism of the brake. Except in so far as any leakage will cause a slight drain on the pressure in the train pipe, any trouble with the auxiliary reservoir is purely local, however, and affects only the one car in the train.

Since the freight and passenger reservoirs are of different construction, we shall have to consider them separately.

PASSENGER "AUXILIARY."

The arrangement for quick-action brake on passenger cars is one which nearly all railroad men are familiar with.

There are only two points on this reservoir liable to leakage - the bleeding cock in the bottom and the pipe which leads from the triple-valve to the reservoir, for, as was said some time before, this pipe must be regarded as a part of the reservoir proper.

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being always open to reservoir pressure.

Any leak at these points makes the brake slow to act, especially in service or graduation applications.

Such a brake will be the last to set and the first to release.

On passenger cars equipped with the old automatic brake the triple-valve is suspended by a bracket from the reservoir, and this makes the nipple connecting the triple and the reservoir very liable to rupture at the thread.

FREIGHT "AUXILIARY"

The arrangement of freight brake is shown on Plate 18 A.

Leakage here is most liable to occur through the bleeding cock (release valve) shown on top of the reservoir, from the reservoir into the pipe (*b*) leading from the triple-valve to the cylinder, or most frequently of all, across the gasket joint between the reservoir and triple-valve (15) at the narrow bridge between the opening to the reservoir and the cylinder pipe.

BLOW FROM EXHAUST.

In the two last cases the leak will show as a blowout of the triple-valve exhaust, which should not always be attributed to some defect in the triple-valve itself.

Brake-Cylinder.

While there are several different styles of brake-cylinders, the arrangement of packing leather and piston head is practically the same in nearly all of them. For this reason we shall first consider that part and the peculiar ills to which it is heir. A section of a cylinder and piston is clearly shown in Plate 18 A.

CYLINDER LEAKS.

Leakage by the piston may occur through dry packing leather, No. 7, a leather badly worn or imperfectly fitted, or some defect in the follower-plate (6), or the bolts (5) which hold it in place. If the leak is in any of these places it will produce a blowout of the vent hole *x*, in the back cylinder head while the brake is set.

Where the leather is to blame, plenty of good oil well distributed is the very best remedy. This softens the leathers and keeps them tight. A thorough cleaning occasionally, also, has a very beneficial effect, though in most cases leather packing will remain tight in spite of dirt if it is kept well lubricated.

Sometimes, although rarely, a leak occurs at the joint between the cylinder and front cylinder head (that nearest the triple-valve), and this may require a renewal of the gasket or possibly nothing more than a tightening of the bolts (14).

The result of the above difficulties will be to cause the brake to come off more or less slowly without any release or blow from the exhaust of the triple-valve.

"STICKING" OF BRAKES.

Sometimes a brake will remain "stuck" after the triple-valve has released, and can only be pried back with a bar. This may be due to the release spring (9) being weak or broken, or most frequently, on freight cars, at least, to a binding because of lack of oil. Sometimes the sleeve-piston (3) gets so corroded as to stick fast in the back head. Where brakes remain set after the triple-valve has released, a careful examination of the levers and rods should be made to see that they do not catch at any point.

For "sticking of brakes" when the triple-valve does not release, see the following chapter.

Steam Engine Running of a "High" Order.

The nearest thing to running a steam engine in the air is that on a drawbridge.

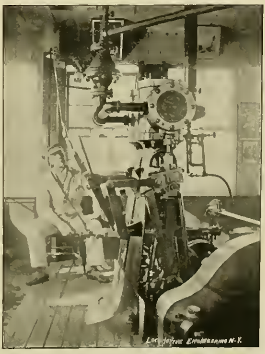
A man in such a position is not bothered much by visitors, nor is he worried much making meeting points. But for all that, we daresay he has his trials and his responsibilities the same as other men who start and stop steam engines.

Our pictures were made from amateur photographs taken by Mr. W. A. Eagles, on the D., L. & W drawbridge over the Passaic river at Newark, N. J. One shows the bridge and the other the "cab" up on top of the big steel span.

Fellows who "bucked" snow last trip without supper and half frozen in a buffalo overcoat may envy the clean looking chap with his slippers on, who seems to be taking things easy.

He does his own firing, which is easy, and keeps things clean, making only a "run" or two a day on an average, but sometimes he has to "go out" pretty often, and he must figure to do this with due regard for the 180 passenger trains that pass under him every day.

Newark Drawbridge, D., L. & W.



Engine House, Newark Drawbridge.

It must be as lonesome as batching on a ranch, and it seems to us would be a first-class job for a man who had a lot of steady thinking to do.

Locomotive Tests on the Long Island Railroad.

An extremely interesting and valuable test of simple and compound locomotives was recently made under the management of Mr. Chas. M Jacobs, consulting engineer of the Long Island Railroad, assisted by Mr. J. V. Davies, assistant consulting engineer. The test was essentially practical, one train having been used all the time, and the same division traversed in about the same time on each day of trial. The compound made a little better time than the simple engine, which would militate against it in coal consumption, and the compound also had the worst weather.

The following report on the test was made to Mr E. R. Reynolds general manager of the road.

The engine set apart for the test by Mr Prince, superintendent M P. were compound engine No 145, and simple engine No. 138. These engines were built by Burnham, Williams & Co., 1893, and are precisely similar, except for the compounding of No 145 on the Vauclain four-cylinder type.

They had both been in the shop for general repairs at a late date and were put on this service as being both in equally good running condition.

For the purpose of this test

1 A train of twenty loaded cars was set apart for the haul.

2 The section of track between Hempstead Crossing and Ronkonkoma was used; and the train hauled the round trip twice each day, making a total daily run of $113\frac{1}{10}$ miles.

3. Two cars of Clearfield coal were set apart by the storekeeper as being from the same mine, and were used exclusively on the series of tests.

4. It was decided to run the test train three days with one engine, and then three days with the other, making a series of tests of three days with each.

5. All coal was weighed on and off from point of start to return to that point, and the water consumption was measured with Thompson patent water-meters attached to the injector or suction pipes.

It will be seen that with the same train over the same course, the work on each day was the same. On the first three days the compound engine was used, on the second three days the simple engine. On the first day's run with each engine the flue tubes and grates and front end were all perfectly clean, and on all succeeding days all conditions were similar, and the engines were in simple running order.

Each day's run for consumption was reckoned only from the time of starting with the train, and each day was concluded exactly at the point of origin, the fires being brought up to level as at starting, and the water in boiler being brought exactly up to the level of top cock. The same engineer and fireman being retained for the whole series.

All weather conditions were averse to the compound engine, as one day (November 4) was exceedingly wet, and on the succeeding day the coal was still soaking from the previous one. The resultant economy, it will be seen, is figured up as $37\frac{8}{10}$ per cent. in coal, and $17\frac{7}{10}$ per cent. in water, on the simple basis of per car per mile; but making allowance for the increased length of terminal stoppages with the simple engine, I have also entered up the economy per car per mile per hour as $32\frac{1}{10}$ per cent. in coal and $10\frac{7}{8}$ per cent. in water, each in favor of the compound engine.

What Causes the Sudden Disappearance of Oil in Sight-Feed Lubricators.

Since the appearance in February of our article on sight-feed lubricators, we have received a number of letters detailing experience in the sudden disappearance of oil from the cups—sometimes one kind, sometimes another.

In each case the writer states that this occurs only when steam-valve has been closed and water or condensing valve left open. This, of course, is bad practice, and directly against instructions sent with all cups. All ask "Where did the oil go to?"

Take another look at the engravings in the February paper, and we will in a word explain the phenomenon.

Observant runners will notice that this will occur quickly and surely when backing up, this is because the condensing chamber of the cup is cooled off quicker.

When steam is shut off from the condensing chamber and the latter cooled off suddenly a partial vacuum is formed and it "sucks," the condensing valve is open and water and oil are drawn up out of the lower part of cup to the condensing chamber through this pipe, and when it reaches the equalizing tubes it is fed to the cylinders very fast, especially if engine is running with steam shut off, as the suction of pistons helps draw the oil out of the cup. Probably this occurs rarely, if ever, when throttle is open.

The remedy is simple—close condensing-valve. Many think there is something mysterious about it as the feeds are closed and no oil goes through the glasses. There is no mystery about it, the oil simply goes up the water tube, through the neglected water-valve, and to the chests.

The steam-valve of any locomotive lubricator should *never* be entirely closed, except there is an accident to the cup.

How to Bore Flues with Air.

Mr Jos. McDonald, of Monett, Mo., writes us that he has had good success in boring choked flues by using a ⅜-inch pipe long enough to reach nearly through the tube, on the end of this he puts a fitting that looks as if it might have been made by using a round file across the end of a piece of pipe—has two points. These loosen up the packed cinders when touched, and the pipe is so small there is plenty of room for them to get back to the firebox. He uses a small hose, but couples direct to train-pipe coupling under deck, as he can then stop and start air jet by handling engineer's valve, says one engine in house with air will admit of the boring of any set of tubes in the house, but recommends that there be enough steam on engine operated on to keep blower going, so as to prevent dust and cinders from annoying operators.

Changed Conditions.

"Speaking about stay-bolts that don't break and firebox sheets that don't crack," remarked a foreman boiler-maker in Colorado, "there are railroads where this comfortable condition of affairs exists; but they are not situated west of the Mississippi River.

"It is all very well," he continued, "for men who never were out of soft-water districts to talk publicly about the best way to prevent stay-bolts from breaking and how to keep flues from leaking. If they had a little experience with the troubles we have to overcome daily, they would be a little more cautious about giving advice.

"Why, I went to see a foreman boiler-maker in a New England railroad shop the last time I was home, and he said to me that every two months was often enough to wash out a boiler, and if a firebox did not last ten years it had been badly used or neglected. He looked as if he would like to say that I was a very accomplished liar when I told him that we had places on the road where a boiler had to be washed out after running 100 miles, and that a firebox lasted only six months. It would be a good thing for lots of boiler-makers if they would read papers like Locomotive Engineering, so that they could keep posted on what is going on in their business. I would gamble that no regular reader of your paper would talk as if the conditions found in his small corner of the country applied to the whole continent.

"But a man must come out here to learn the hard lines of a boiler-maker's business. When I struck this place first my whole experience had been on roads in Pennsylvania. I went to Mr. Sample and asked for a job. He seemed willing to take me on, but first asked if I could set flues.

"'Set flues,' I said, 'that is my best hold. I guess I can set flues with any man in the trade.'

"Well, I was hired, and my first job was setting the flues of an engine that had got a new boiler.

"'Take your time with them,' Mr. Sample had said. 'All we care for is a good job.'

"I took my time and no flues were more carefully set. The engine went out on a trip shortly after, and on her return the report was put on the book, 'flues to be calked.' I was amazed, but I went into the firebox, and, sure enough, the flues were leaking. I believed that the engine had been badly used, but I made up my mind to fix these flues so that it would take pretty hard usage to make them leak again. I spent the greater part of the night toiling in that firebox, and made up my mind that there would be no more leaking for some time. When she got in the following night the report was again made, 'flues to be calked.'

"I calked them several nights, and then I got discouraged. I went to Mr. Sample and said that I intended to quit. 'What do you want to quit for?' was asked.

"'Well, the fact is, that I have had some reputation as a boiler-maker, and I don't want to lose it all here. There is that engine, I did the best job I know how on her flues, and she comes in leaking every trip.'

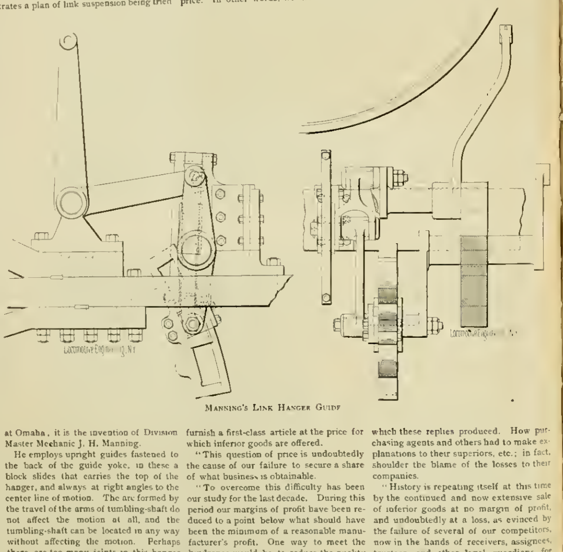
"'But she's never lain down between stations, has she?'

"'No, it's not so bad as that, but when I can't do a job that will stand I want to give up.'

"'You look at it the wrong way,' said Mr. Sample. 'You are forgetting the effect of our water on flues. You have done as good work as any of our boiler-makers ever did. Go back to your work, and I shall make you foreman next month.' I went back, and here I am."

New Plan of Suspending Links.

The engraving shown herewith illustrates a plan of link suspension being tried at Omaha, it is the invention of Division Master Mechanic J. H. Manning.



Manning's Link Hanger Guide

He employs upright guides fastened to the back of the guide yoke, in these a block slides that carries the top of the hanger, and always at right angles to the center line of motion. The arc formed by the travel of the arms of tumbling-shaft do not affect the motion at all, and the tumbling-shaft can be located in any way without affecting the motion. Perhaps there are too many joints in this hanger arrangement, but the device has some merit no doubt.

Against Inferior Goods.

Railroad companies, as a rule, order material which is reliable in preference to that which merely has cheapness to recommend it. The hard times, are, however, seducing many roads, which have followed the sound policy of quality first, into the false practice of trying what is cheapest. They will pay for it in the end. The tendency in the direction of poor, cheap goods is hard on the more reputable manufacturers, and their business suffers, while the makers of inferior articles make inroads on the market. Much pressure has been put upon makers of first-class goods lately to produce inferior articles to meet the competition in their line. We are glad to find that most of the manufacturers refuse to do this, and are willing to put up with smaller business until the clouds roll by. We publish below an answer from one of our largest spring makers to agents who had urged the manufacture of inferior material. The arguments used would apply equally well to many other lines of business.

"After an extended experience in the field, am fully convinced that our success in holding the business we have, and adding to it from trade that we have not been the recipients of, is to hold to the methods by which we secured our business and the reputation of manufacturing the best goods in our line that are offered to consumers of railway springs.

"There is no doubt that we have this reputation to-day, the proof of which is that in a large majority of cases we can secure the trade at equal or a slight increase in any prices quoted.

"The quality of our goods is unquestioned, the only obstacle is our higher price. In other words, we are desired to furnish a first-class article at the price for which inferior goods are offered.

"This question of price is undoubtedly the cause of our failure to secure a share of what business is obtainable.

"To overcome this difficulty has been our study for the last decade. During this period our margins of profit have been reduced to a point below what should have been the minimum of a reasonable manufacturer's profit. One way to meet the hindrance would be to reduce the quality of the goods, as well as the labor necessary to produce first-class goods universally our product.

"The result of this plan would be to offer to the railway trade that we cannot now reach a cheap and inferior class of goods, that we have not only denounced, but always refused to make, and at the same time our reputation of retaining the anterior position we now occupy of the manufactures in our line, and would lose the confidence of our patrons which we have merited by our policy of honest production, moderate prices, and fair treatment.

"The solution of the present disturbing situation will be rapidly and finally solved in the growing use of these cheap goods. The market is being largely supplied with all classes of springs, made, not of crucible or open hearth, but by the use of Bessemer steel, which all experienced manufacturers admit is characterized by an utter lack of uniformity, and while adapted to many purposes is not suitable to make a good quality of spring. Yet there are manufacturers, who, perhaps from a lack of knowledge of their business, or want of thought as to responsibility, do not hesitate to offer five year guarantees of service on such springs, and, strange as it may appear, there are many railway officials willing to be satisfied, provided the prices are the lowest in the market, evidently losing sight of quality or responsibility of parties making the guarantees.

"History repeats itself, and during and after the depression of 1873, it must be remembered that but three concerns in our line out of some dozen stood the financial crisis, and when the others were called upon to make good their guarantees, the railway officials were met with the reply that the old companies had gone out of existence, were in the hands of assignees, or reorganized, and the new organization or assignees could not or would not make good the guarantees of their predecessors. I remember very well the consternation which these replies produced. How purchasing agents and others had to make explanations to their superiors, etc.; in fact, shoulder the blame of the losses to their companies.

"History is repeating itself at this time by the continued and now extensive sale of inferior goods at no margin of profit, and undoubtedly at a loss, as evinced by the failure of several of our competitors, now in the hands of receivers, assignees, trustees, and other legal guardians for these weaklings. Yet the sympathic railway officials patronize them and accept their guarantees, which have no legal or other foundation, as against the responsible guarantees offered them by manufacturers of superior goods, but at a higher price.

"The result will be, as it was in 1873 and several years following, continued failures of manufacturers, extensive failure of goods, inquiries by general managers as to causes, reference to mechanical departments, reports from them, and explanations from purchasing departments that no recompense is obtainable for replacements and losses. This will be an accompanying requiem ere the sun dawns on an improvement in business."

In a communication from Mr. S. L. Bean, in the last number, it was stated that twenty minutes was the time consumed in jacking up a car with their pneumatic jack this should have read three minutes.

Some Home-made Testing Devices.

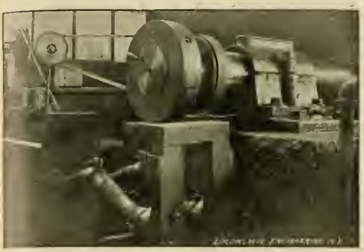
Our illustration was made from a snap shot taken in a corner of the engine room at the Shoreham shops of the M., St. P. & S. S. M. Railway, and shows some little tricks of their own for testing air-brake hose, speed recorders, etc.

Between two wooden uprights can be seen two pieces of air hose. They are under the same pressure they must stand in road service, and a whistle signal is arranged to give warning when a leak appears. A crank is arranged below them, on which an upright pitman works. The upper end of this is forked so as to "wobble" two pieces of hose at the same time. The crank-shaft is driven by a belt from a wooden pulley on the end of the engine shaft, and is speeded up to 130 revolutions per minute.

Of course, every rubber man has the "best" hose; but instead of taking his word for it, two kinds of hose are tested in this machine. In a recent test, a hose known as the C. P. Standard was tested with one of the N. Y. Belting Co.'s hose. They stood the "razzle-dazzle" for eighteen hours per day six days in the week for six weeks before either of them "hollered." Then the C. P. Standard gave in and up.

This device was gotten up by C. A. McClelland, general foreman, and the foreman of the back shop, whose name we have forgotten.

On the bench is shown a Boyer speed recorder with case removed. As can be seen, it is belted up, and this arrangement is used to test them before placing on engines. By the way, this road uses a "Boyer" on every road engine, and they are a good thing.



TESTING AIR-BRAKE HOSE.

The Solid Steel Works.

One of the best managed metallurgical establishments which we have ever visited is the Solid Steel Company's works at Alliance, O. When the place is in full working order it employs about 600 men, but at present they are not working much more than one-half of their regular force. The works were started about eleven years ago, and were increased gradually to meet the demands of business, the policy of making a first-class product having raised a growing demand for steel castings of the kind made at these works.

Just before the panic came on, the company built a large new rolling mill, which has a capacity of 1,000 car couplers a day, but the sudden falling off of demand has prevented the company from putting it in operation. The mill, when finished, will be one of the best establishments ever devoted to the making of steel castings.

The company make an immense variety of steel castings for railroad machinery, and for every other line where combined strength and lightness is desired. An engineering visitor to these works cannot fail to be impressed with the intelligent care and skill displayed in carrying on the work. Another attribute is very manifest—humanity. This company has felt the pinch of hard times as severely as their neighbors, but they have followed a policy dictated by a spirit of fairness and founded on a basis of justice. They have posted no notices of a 10 per cent. reduction or of any other reduction. The workmen are, to a great extent, engaged on piece-work, and they receive as much for their labor, as the prices paid will warrant. When the depression due to the present condition of trade came, the manager, Mr. Williams, an old railroad train master and an essentially fair man, invited the men interested to come into his office and consult about how the company could compete for work on the prices quoted by competitors. The whole circumstances were laid before the men, and in every case they were ready to do the work for a price which would enable the company to bid on the contracts. This is the best kind of result from a practical application of the doctrine—"Let us reason together."

In most manufacturing establishments there are fines or marks of disapproval for men who fail on certain operations. Here the policy is followed of giving premiums for good results. A difficult operation in steel metallurgical establishments is making the plug which opens and shuts the opening at the bottom of the ladle, so that it will stop the flow of metal when the various molds are filled. A badly made plug will frequently lose the greater part of the charge. Here the men are given a premium for each plug that works without loss. It is wonderful the skill developed by this premium system.

The engineering part of the establishment has been developed by Mr. Roepper, the superintendent. He appears to be exceptionally successful in working out details. There is always considerable danger in metallurgical establishments of men getting burned through the accidents of chains giving way and permitting the vessels filled with molten metal to fall among the workmen. Some horrible accidents have happened in this way. In the Solid Steel Works no chain or hook that is used in supporting molten metal is employed longer than six months, and while in use it is subjected to daily inspection. No workman has ever been killed or burned in these works. Prevention is better than cure.

The popular railroad supply man, Mr. J. K. Bole, has large interests in these works.

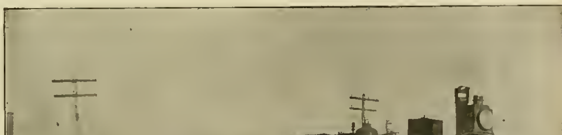
Bucking Snow.

Our engraving on this page was made from a photo taken by W. J. Morrison, of Sacramento, at Truckee, Cal. It shows three Schenectady compound Hogs ahead of a freight train, and ready to pull out.

This style of wedge plows with several large engines behind it represents the brute force plan of moving snow that was universal on the Western roads of this country ten years ago. It is a poor snow-mover, dangerous and a waste of power, yet there is something in it that is exciting to those who make the charge, and the Junior Philosopher acknowledges that there was a time not long ago when he "figured" to get a snow-plow engine.

The day of "shoving" snow down the bank (and incidentally engines and men) is almost past. The modern machine plow is so efficient, so economical and so safe that no progressive management of a line at all hampered by snow in the winter months can afford to risk men and power with wedge plows. The rotary has shown that it can *cut* and *throw* snow just as a wood matcher cuts and throws shavings, and is as much ahead of the wedge plow as the matcher is ahead of an axe.

Since writing the above a very serious accident has happened in California by a string of engines and a wedge plow going over an embankment.



SNOW BUCKING.

A new form of continuous drawbar mechanism has been patented by Perry Brown, Sharonville, O. The connection between the two drawbars is made by two rods, one at each side, secured to the follower blocks.

Meddling with the Railroad Mechanical Associations.

OFFICE OF THE RAILROAD GAZETTE, }
CHICAGO, February, 1894. }

MY DEAR SIR—I learn that the question of consolidating the Master Car Builders' and the Master Mechanics' Associations into one railroad association, having a new name, is being considered by some of the members, and I write to ask if you will kindly give me some advice about the proper position for the *Railroad Gazette* to take in the matter.

It is claimed that the higher officers of railroads would favor the consolidation, as it would give the men in charge of the mechanical departments a chance to attend both conventions without losing any more time than would be required for one, and that the result of the combination would be good for all concerned.

It is also claimed that the car and locomotive department properly belong in one department of rolling stock, and that this is shown by the universal tendency to combine these departments, instead of separating them, whenever there is a change of officers, and, therefore, there should be but one rolling stock association.

Your reply will be considered strictly confidential, and the *Railroad Gazette* will be grateful for your opinion.

Very truly yours,
DAVID L. BARNES.

The above is the copy of a letter which has been sent to a number of the leading members of the Master Car Builders' and Master Mechanics' Associations. We have no doubt but they all duly appreciate the meddlesome spirit displayed by the *Railroad Gazette*. We are inclined to think that most of the members of the associations are competent to attend to their own business, and that any position taken by the *Railroad Gazette*, or any other publication, will not influence consolidation one way or the other. We doubt the truth of the assertion that "the higher officers of railroads would favor consolidation."

A correspondent in Butte, Montana, writes us some notes about the operating of the Montana Union. He gives a great deal of commendation to Mr. George Lindoff, master mechanic of the road, who, according to our correspondent, converted chaos into order and put the rolling stock of the road into a remarkably good shape at small expense. It appears that the completion of the Butte, Anaconda & Pacific Road is likely to ruin the business of the Montana Union, as parties who are interested in the establishments which supply most of the freight from Butte are interested in the new road. Some remarks are made about the Shay locomotive used on the road, and it is said to be remarkably efficient for slow, heavy pulls.

A Railroad Profile of Some Use.

All roads have profiles to show the grades, and mighty few there be that show more, and some require another profile and a slide rule to explain them

The best thing of the kind that has come to our attention of late is the profile used on the C, St P & K C Ry We don't know who designed them, suggested the idea, or worked out the details, but it is all done well

Our engraving shows the Waverly branch of that road, and tells more than any profile we have yet seen. When furnished to a dispatcher, it seems to us it must be of some use to him—a question, when some profiles are sent.

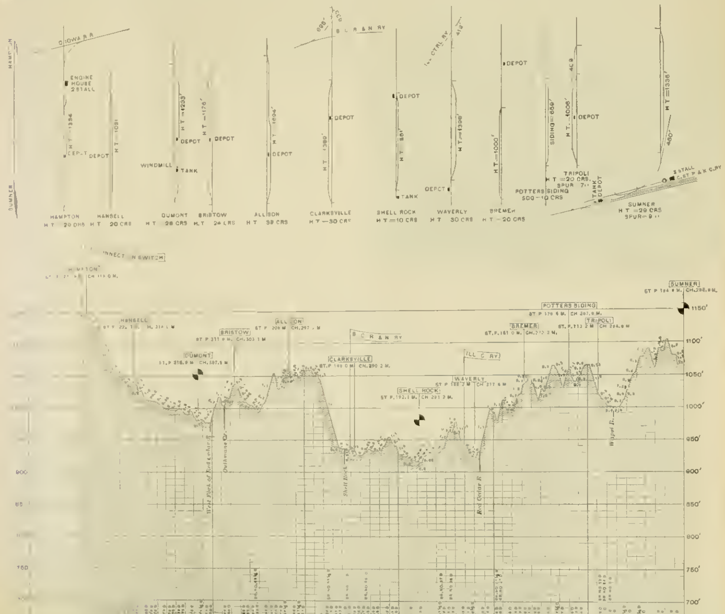
We do not know of a more lucid explanation than that contained in a "note" on the blue print, which reads as follows

"The undulating line shows the rise and fall of the track, the flags show the railway crossings or connections, the circles with black and white cross show water stations, the horizontal signs indicate stations with distances below from Chicago and St. Paul.

"Each vertical line drawn from the undulating grade line to the horizontal datum line indicate the mile posts, the horizontal lines marked 650, 700, 750, etc., indicate the height in feet above the level of the sea. The bridge numbers are put down just above the 650 horizontal line and are marked BR No. 570 D, &c. Below the datum line the alignment of the road is shown. The offsets from the center line indicate curves right and left, the ones above the horizontal center line are curves to the left, and those below the same curves to the right going west. The longer the offset the sharper the curve, the wider the offset the longer the curve

"The curvature is given and indicated thus 1° C, 2° C, 3° C, &c., the length of curve is given in feet right after the degree of curve A 1 curve has a radius of 5730 feet, a 2 C, 2865 feet, a 3 C, 1910 feet, a 4 C, 1433 feet, a 5 C 1146 feet, a 6 C, 955 3 feet, etc

"The upper part shows the length of all sidings and the capacity of side tracks in number of freight cars, for meeting of trains this capacity should not be exceeded.



"The lower end of the siding is west. 'P. T.' means passing track, 'H T.' house track"

The Q. Compound Locomotive.

The two cylinder compound locomotive in use on the Chicago, Burlington & Quincy, built at the company's shops four years ago is giving good results in freight service She is working on the chain gang, and is run by any crew that happens to fall to her, just the same as any other engine. She is reported to cost no more for repairs than other engines. Some time ago there was an agitation about the cost of fuel, and the record of all the engines on the divisions where the compound is running was looked up. The record for the compound was 3 27 pounds of coal per loaded car mile. The best record for any simple engine of the same class was 3.85 pounds, for the poorest, 6.32 pounds, for the average of forty engines, including the compound, 4 61. So that the saving made by the compound was as follows Over the best record of any other engine in the same class, 15 per cent., over the poorest record of a simple engine, 52 per cent.; over the average record of forty engines of the same class, 29 per cent As this record of the compound is almost a duplicate of a similar record made when the engine was new, it seems to us there is no escape from the conclusion that this compound, at least, is saving at least 25 per cent.

Some Experiments in Hardening and Annealing Steel.

BY W. G. LOTTES

It seems that one of the greatest difficulties to overcome in forging at the present time is the unequal strain that is caused by hammering, both in steel and iron. This is, perhaps, not noticed so much in rough forgings as it is in those that have to be finished up in lathe or planer.

To illustrate this, take a thin piece of iron or steel and lay it on the anvil and strike it with a hammer. The piece is made thinner and the diameter is increased. Blacksmiths very often do this at a very low heat, and forget to anneal it afterwards. Very often this piece is finished up and, if of iron, is brought back for the smith to case-harden, the result is that his piece warps so that he has to reheat it, and they try to straighten it, and by the time he gets through it is a poor job, if not scrap.

Suppose the piece is thick instead of thin, and it receives the blow of a hammer as before. The effect of the blow extends only a little way in, the surface is made longer and broader, but extension of the inner part is resisted, and the material at the surface is put in compression and the inner portion in tension.

If the piece is finished up at a red heat the material is soft and weak, and yields to the stresses caused by the hammering, and the stresses are equalized. This goes to show that internal stresses are generally the result of cold working.

Iron can be almost entirely relieved of these stresses by heating it to a red heat and letting it cool slowly—not as is done very often, thrown out of doors when it is twenty below zero, or on a damp, cold floor.

In the manufacture of rough iron made from old scrap of different grades, the scrap is piled in bundles and put in a furnace, heated to a melting heat, then put under the hammer or rolls and drawn into long bars; the better grade of iron in this will not melt at as low a heat as the poorer grade, and is not as soft when put under the hammer or rolls.

Now, it seems to me that this will cause tension, that is a very difficult matter to relieve by annealing. We find that when this iron is put in a lathe or planer the chips from the tool will break more readily in one place than another, and the piece will finish different in places, smooth in one while rough in another.

In steel these internal stresses, caused by hammering, are a more difficult thing to overcome than in iron, especially in tool steel, and are very often caused by the blow of a hand hammer while the steel is at a red heat, and the cause of this is the hammer being so light it only effects the steel on the outside and in small spots. Now, some men tell us that by annealing we can relieve all these internal stresses. I have experimented considerable for the last two years on this, and find that it is an easy matter to put internal stresses on a piece of steel with a hand hammer while the steel is at a red heat, but a very difficult matter to relieve the steel entirely of these stresses by annealing.

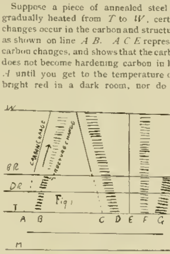
I have taken a piece of ⅞ round steel 10 inches long, and pended with a ball-pene hammer in the center on one side while it was at red heat, then put it in annealing box, where it took 24 hours for it to cool. It was then turned up, taking $\frac{1}{16}$ of a cut off from each side, and when we came to harden it would warp right where I pened it every time. I have also had the same experience with thin pieces used for saws for milling machines.

As a rule, when a blacksmith warps a tap or reamer in hardening, the cause is thrown on the steel, or when one cracks a piece in hardening or a piece don't work as it ought to when it has gone through these processes of annealing. Here is where a large percentage of steel is ruined.

For illustration, I have tried to make some sketches showing the changes the steel goes through from the time it is of an atmospheric temperature till raised to a white or melting heat.

We find that by heating the steel we change the hardening carbon to a non-hardening carbon or the non-hardening to hardening carbon, which is shown in Fig. 1. Line A at T we have the atmospheric temperature. At $D\ R$ we have it changing from a black heat to red. At $B\ R$ we have a bright red, and at W a white.

Suppose a piece of annealed steel be gradually heated from T to W, certain changes occur in the carbon and structure, as shown on line $A\ B$. $A\ C\ E$ represent carbon changes, and shows that the carbon does not become hardening carbon in line A until you get to the temperature of a bright red in a dark room, nor do we



change the structure of the steel until we get to that heat, as shown in short horizontal lines B.

Line C shows a gradual temperature change of carbon downward. While the short horizontal line B shows the structure changes downward, and shows that if you heat a piece of steel above $B\ R$, or bright red, and then let it cool down to just above the temperature where the carbon changes from hardening carbon to non-hardening, and quench it at that heat, we do not refine the steel any. If it has been overheated previous to this, it will not refine at any heat, and is what we call burned steel.

But we have got to heat steel to a great deal higher heat for forging than we do for hardening. Here is where a large percentage of blacksmiths make their mistakes. They get a tool to dress, it is put in the fire and heated up to a forging heat, and shaped and hardened at that same heat, and when the steel does not refine they curse the steel. There is no steel that will refine by putting it through the above process. If you take this same tool and let it cool off gradually to the atmospheric temperature, or quench it if there is no danger of cracking it, then reheat it to the lowest heat it will harden at, which is just to that heat where the non-hardening carbon has changed to hardening carbon, and your steel will refine and will not harden in over ⅛ of an inch (as shown in Fig. 2) in water at a temperature of from 32 to 35 degrees, and there is very little danger of cracking it by quenching it in ice water.

$E\ F$ shows a piece of steel overheated for annealing, and one way to restore it is to heat it to the lowest heat it will harden at, quench it and reheat it to the same heat, and let it cool slowly, and we have a structure as shown in G, soft and tough, and if properly heated will refine in hardening. Here very little or no change occurs either in carbon or structure until you reheat it for hardening. If properly heated, then you get a structure as shown in Fig. 2, hard and fine on the outside, core soft and tough, which is the best structure that can be obtained for all ordinary cutters.

I have taken a ¾ tap 6 inches long, Crescent special steel, and hardened it fifteen times in succession in salt water at a temperature of 35 degrees, and gave it this structure every time and the tap was perfectly sound after hardening it the last time. But I shortened the tap about two one-thousandths of an inch every time I hardened it, one-thousandth in quenching it, and one-thousandth in softening it.

Now, some may think that the shortening of the tap is due to a peculiar kind of steel. This is not true. All steel that will refine in hardening will contract, and if in the shape of tap or reamer, it will contract in length and expand in diameter, which is due to the way the water cools the steel. Cooling the outside first, which you cannot prevent, and it is brought to its natural condition before the water has any effect on the inner portion of the steel; but when the outside is cooling, it carries the inner portion with it because it is hot and soft. But when the inner portion gets to the same temperature of the water, it must have its natural shrinkage. And if there is a great deal more of it, it will carry the outside with it; at any rate it will cause an awful strain on the inner portion of your tap.

Just as soon as you start drawing the temper of your tap you begin to relieve that strain. Yet you don't change the structure until you heat it to very near red heat. But the carbon seems to begin to change to non-hardening carbon from the time you heat your tap to a straw color till you get it to a red.

The tendency to change hardening carbon to non-hardening is probably strong at all temperatures below that of a dark red, and in the case of hardened steel it is held from being operative by the sudden cooling, because it renders the material more resistant to the tendency to change of carbon. If, however, a piece of steel which has been hardened be slowly heated, it is found that the tendency to change becomes operative at a temperature very much below a dark red. Thus, if it be heated to a temperature corresponding to the formation of a straw color oxide, there will be some softening of the steel. If, then, steel be heated to a bright red and cooled by quenching to a black heat and allowed to cool slowly the fine structure will be retained, and the hardening carbon will have had a opportunity to change back to non-hardening carbon, and the material will be soft and tough.

This method was applied with great success to the toughening of car axles by Mr. John Coffin, at the Cambria Iron and Steel Works, at Johnstown, Pa. It is claimed if steel be melted and quenched from the fluid state the carbon will be all hardening carbon, and the structure will be exceedingly fine, but if it be allowed to cool until it gets solid, and then to be cooled by quenching, the carbon will be non-hardening and the structure will be coarse.

These facts have been proved and apply to the annealing of steel castings.

There has been a very general impression that very slow cooling of steel castings after being hard would result in toughening and softening them.

The above facts, however, lead to the conclusion that heat treatment would result in softness and brittleness, and experience proves this conclusion. But if they be quickly cooled to a dark red, then allowed to cool slowly through the rest of the temperature range they will be soft, fine grain and tough.

In large castings this heat treatment was attained by Mr. John Coffin by allowing the casting to cool below a dark red, then placing it in a reheating furnace, where the temperature was raised to a bright red heat; the fires were then drawn, the furnace doors were opened, and the castings were cooled as rapidly as possible by the admission of air till a black heat was reached; then the furnace was closed, and the castings were allowed to come slowly to the temperature of the air.

Madison, Wis.

Held On to the Right of the Road.

"That is a good letter you've got," remarked Master Mechanic Brown to a tall, earnest looking man with clear-cut features and keen gray eyes, who was in search of a job as engineer.

"You appear to be a man who would keep your wits about you and be ready in a pinch. What was the matter that you lost your job on the Prairie Midland?"

"To tell the truth, Mr. Brown, I got into a dreadful scrape, and I do not blame the superintendent for discharging me; but you may rest assured that I shall never get into a mess of the kind if I strike another job."

"What kind of a scrape was it?"

"It was nothing more or less than stopping the business of a division for five hours and delaying a fast stock train that length of time."

"How did it happen?"

"Well, I was pulling a stock train that the company were trying to push through to Chicago on the fastest possible time, and I had been given the right of the road against everything but passenger trains. All the crew were doubling back without any rest, and we had been over twenty-four hours on duty. It was away about midnight when we stopped at Elms, a small station without a telegraph operator. We side-tracked there, because we could not make the next station, for passenger train No. 8."

"Now it happened that a farmer with a place close to this station was on our train with some cars of stock that he had bought further West, and he took the chance to run in and get something to eat. Very generously he sent a bountiful supply to the caboose for the trainmen, and Jim Forrest, the conductor, sent word for me and my fireman to come back and get a share. There seemed to be plenty of time, for there were no signs of No. 8, and we could see her headlight seven miles away.

"We all sat down in the caboose and had a good lunch. Besides eatables there was a good supply of milk and a big jug of hard cider. Eatables and drinkables were finished, and still no signs of No. 8. Everybody made themselves comfortable to wait for the train. There were comfortable cushions to rest on and they felt good to men who had been teetering in that hard-riding mogul for twenty-four hours. If you ever sat on an engine that rode like a dust-cart and felt as if your ribs were rattling apart, you will understand how nice it was to get ten minutes repose on a soft cushion.

"I imagined that I was still repeating that to myself for the third or fourth time when I vaguely heard a rich Milesian voice shout:

"'By Jasus, it's me self as found the childer of the wood. Luk at the sleepin' beauties!'

"We all started up. The last one of us had been asleep for six hours, and it was broad daylight.

"The man who roused us was the track foreman, who had come from the telegraph station, eight miles distant, with his hand-car to get a report of the wreck. They supposed at headquarters that we were in the ditch, and were anxious to know the extent of the damage.

"The engine was cold, but there was plenty of water in the boiler, and a good supply of fence rails soon raised steam. When we got to the telegraph station we found several miles of trains waiting, as we had rights over them.

"We got the train through as quickly as we could, but we did not get the chance to go out again. The super. said that the good of the service demanded that every one of us should be discharged, and what he says goes.

"These are the exact facts, Mr. Brown. You may be sure that if you give me a job I'll keep away from the way car when I happen to be worn out."

LOCOMOTIVE ENGINEERING
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Cylinder Condensation.

From the character of inquiries sent to this office during the last year, we would judge that a great many of that portion of our young readers who devote attention to steam engineering matters are interesting themselves in the subject of cylinder condensation. The subject is rather a difficult one to understand, and many of the books treating upon the subject are so charged with algebraic formulæ that they repel the ordinary practical man. We shall therefore tell in plain prose a little of what we have learned about cylinder condensation and its effects upon the operation of the steam engine.

The first form of practical steam engine employed was called an atmospheric engine, because the principal power was derived from the pressure of the atmosphere upon an open piston, a vacuum having been created below the piston by the condensation of the steam. This was the Newcomen engine. James Watt, an instrument maker in Glasgow, Scotland, was asked to repair the model of an engine of this kind, which was used for educational purposes in the University. He knew a good deal about natural philosophy, and was keen enough to see that an enormous amount of heat was wasted by injecting cold water into the cylinder each stroke to condense the steam, for the metal had to be heated up to the temperature of the incoming steam before there was any real steam to form a vacuum from. Watt conceived the idea of condensing the steam in a separate vessel (condenser), and that laid the foundation of his fame and fortune, giving at the same time the world an engine adapted for manufacturing purposes, an engine that did work with fair economy of fuel.

The steam engines developed by Watt and others were not long in use when it was discovered that there were serious losses of heat in the cylinders. This was long attributed to radiation, and the practice arose of jacketing the cylinders with non-conducting material. Others introduced steam jackets. In 1848, John Bourne, author of a famous book on the steam engine wrote, "A material advantage is derived from the use of the steam jacket, though on what principle such an economy should result is not easily discoverable. The jacket presents a larger cooling surface than the cylinder itself, so that its use might reasonably be supposed to occasion an increased loss from condensation, nevertheless, of two engines, in every respect identical, but one provided with a steam jacket and the other without it, the engine without the jacket has given considerably inferior results."

About the time the words quoted were written, D. Kinnear Clark was experimenting with locomotives to find the conditions of operating which were calculated to be most economical in the use of fuel. A celebrated deduction of his experiments was, that beyond a very narrow limit "expansive working of steam was expensive working." This was at first stated as a fact without an attempt at explaining the cause, but further investigations of Clark, in Scotland, and of Isherwood, of the United States Navy, demonstrated that serious steam losses were caused by the changing temperatures of the cylinders, the metal of the same being constantly inclined to get hot and cold according to the temperature of the steam passing through the cylinders. The use of the steam engine indicator proved that the volume of steam indicated as passing through the cylinders was much less than the volume of steam evaporated. The loss varied from 10 to 30 per cent. It was found that this loss was due to cylinder condensation.

Those who merely view the cylinder of an engine as an intensely hot vessel at all times when steam is passing through, do not readily realize how it could become so cold as to cause condensation of the steam after steady work has begun. But heat in a cylinder has degrees of comparison the same as the heat and cold of an October day. When steam enters at 150 pounds pressure the temperature is about 358 degrees Fah., when it passes out at, say, atmospheric pressure, the temperature is 212 degrees Fah., a difference of 146 degrees. This is a wide difference, and the temperature of the metal in the cylinders naturally keeps changing with the temperature of the steam. The saturated steam which enters the cylinders is always at the dew point, not possessing more heat than what is necessary to keep it in a gaseous condition. On meeting with a colder body as it does when entering the cylinder, part of the heat is abstracted to raise the temperature of the metal, and a portion of the steam becomes water or watery vapor, which has no power for doing work. During the whole period of expansion and exhaust, the surface of the metal forming the sides and ends of the cylinder and piston is undergoing a cooling process from the combined effects of radiation to the moist steam, which is noted for its avidity in absorbing radiant heat, and conduction to the condensed steam which draws heat from the metallic surfaces sufficient to convert the water vapor back into steam.

To put the case briefly. The steam in entering the cylinders goes into something like a condenser, and a portion is converted into water. As expansion proceeds and the pressure decreases, the condensed steam inclines to vaporize, and it takes heat from the walls of the cylinders to help the process. The re-evaporated steam is now about to pass out of the cylinder, so there is no gain from the return of the water to steam vitality at the end of the stroke. On the contrary, there is loss, for the revaporization has been brought about partly at the expense of heat drawn from the cylinder walls, and the augmenting pressure at the end of the stroke increases the back pressure against the piston on the return stroke. The real cycle of steam behavior is that the cylinder acts as a partial condenser at the beginning of the stroke, and as a steam evaporator or boiler at the end of the stroke. In this process the heat drawn from the cylinder metal toward the end of the stroke is cooling down the material to prepare it to perform its refrigerating action when the steam is admitted for the return stroke.

These conclusions were arrived at by Clark, Isherwood and other engineers by the aid of the steam engine indicator, but in the last few years more positive testimony has been furnished substantiating the testimony of the indicator diagram. Many of the engineers who are conversant with the experiments described by Professor Tyndall in his "Heat, a Mode of Motion," have tried to devise a thermo-pile such as the famous scientist used in hopes that they could make graphic record of the varying temperature of a steam engine's cylinders. The changes of temperature occur with such amazing rapidity, that for a long time the apparatus tried to make records failed to work; but within the last few years Prof. E. H. Hall, of New York, and Mr. Bryan Donkin, of London, have each perfected appliances which gave fairly accurate indications of cylinder temperature during the different parts of the piston stroke. These records agree with the calculations made by Clark, Isherwood and others, based on the indicator diagram and boiler evaporation. The testimony, in short, is, that the cylinder condensation and re-evaporation is a real source of loss. The lesson of the testimony for locomotive men is: Do not attempt a wide range of steam expansion in simple cylinders, and use every practical means to protect the cylinders from the cold blasts of the atmosphere.

High Speed Locomotives.

A very interesting contribution to the literature of this age was made by a paper read at the Western Railway Club, by Mr. Quereau, engineer of tests of the Chicago, Burlington & Quincy. The paper contains an excellent summary of the advances made in the vital elements which have produced the high-speed locomotive of to-day. The limitations which control steam distribution, the functions of the different parts of the mechanism are clearly described, and an excellent plea is made for a more general use of the steam engine indicator. The paper is evidently the work of an expert in locomotive engineering, who has collected an immense amount of valuable data on which to form the conclusions arrived at. The paper is clear and logical, and although there are some points made which we think controvertible, as a whole it is well worthy of study and is a safe guide to those who have had limited opportunities of studying locomotive operating from the highest standards.

The paper opens by citing the requirements and demands upon high speed locomotives, and presents the conditions and narrow limits inside of which the designer must confine himself. It has been established that the resistance at high speeds is not as the square of the velocity, as formerly believed, but about equal to one-quarter the velocity in miles per hour, plus two, so that the resistance at sixty miles per hour is only 50 per cent. greater than at thirty miles per hour, which demonstrates clearly that there is economy in increasing the speed. This, of course, imposes great demands upon the motive power department, as a given power is required to be furnished in a shorter time.

Some of the points discussed are larger boilers, higher steam-pressures, larger driving wheels, the latter being desired to supply the required train velocity with a slower piston speed, thus giving the steam more time to pass into and out of the cylinder. The paper very clearly illustrates this advantage by showing the higher steam line in the cards taken from engines after the diameter of drivers was increased. When drivers were increased from 62 to 68 inches there was a positive gain of 2.25 pounds of water evaporated per dynamic horse-power per hour. The beneficial results of decreasing the lead was demonstrated to be well worthy of attention. There is a tendency on many roads to give much lead to valves. Master mechanics who have a tendency in this direction would do well to carefully study the discoveries recorded in Mr. Quereau's paper. There has been an inclination in many quarters to believe that the use of the Allan port produced no economy in the steam distribution of locomotives. The paper referred to discusses this subject, and finds that a decided gain is obtained by the use of the Allan valve, the mean efficient pressure being decidedly greater where it is employed. The subject of long and short travel is discussed, and again attributed to the lengthening of the travel from 5 to 5½ inches. While we do not agree with the author on this point, he gives certain facts which seem to substantiate the position he takes. We regret not having room for this paper as it is a very valuable one for those interested in economical operation of locomotives.

Hot Journal Boxes.

The subject of hot journal boxes has been up for discussion again in the New England Railroad Club, and it gave rise to some interesting talk, in which practical railroad men and college professors vied with each other in demonstrating the causes which produce hot boxes. Hot boxes seem like the poor, always destined to be with us. The discussion of the subject seems always to be seasonable, for what is said is certain to give hope or information to lots of men who are harassed with the trouble talked about. There are no doubt numerous causes that will readily induce journals to run hot, but as a rule there is no great mystery about this source of annoyance and delay. A man who travels a great deal soon finds that on some roads he may expect delays from hot boxes on nearly every trip, while on others this trouble is so rare that it is a matter of surprise when it happens. If the cases are looked into closely, it will be found that on the roads where a hot box is a rare occurrence the best of bearings are employed with well fitted trucks, and that first-class lubricants are held to the journals by elastic packing. On the roads where hot boxes are common, cheapness in first cost is the policy followed, and the account is balanced by delay, heartburnings and all round annoyance.

If the men in charge of railroad rolling stock were permitted to have their own way about the selection of metal for bearings and of the lubricants to be employed in keeping them cool, there would be very little trouble with hot boxes. We notice that on most of the roads where hot boxes are chronic, varied by epidemics of the malady, the mechanical department have little influence in the character of the supplies purchased. A most unfair thing about this trouble is that the mechanical men are nearly always blamed for the recurrence of hot boxes. No end of ingenuity is devoted to imagining far-fetched causes for the difficulty, when the real cause is on the surface. At the railroad club meeting referred to the causes for hot boxes talked of were: Too much weight on the bearings, bad fitting of brasses and defective forms, improper packing, boxes that admit grit and dirt to the bearings, unsuitable material and inferior lubricants. We feel safe in asserting that 90 per cent. of the hot boxes arise from the two last-mentioned causes. If they are remedied the course for complaint will be small. The seamy journals that are found in axles made of inferior iron are probably responsible for not a few hot boxes, and neutralize the use of good material in bearings and good oil.

Passenger Car Construction.

A somewhat radical change on passenger cars has been recommended by Mr. Ernest Merrick, a mechanical engineer, who was for some time superintendent of a department of the Pullman Works. He proposes abolishing the platform entirely and coupling up passenger cars in the same way that freight cars are coupled. He has patented a car design in this way, and there are certainly very good reasons why the plan should be adopted. Instead of using the platform as the approach to the end doors, doors are placed in the corners of the car, and appear to be as easily reached as those that are placed at the ends The platform was originally placed on a passenger car principally as a convenient place for reaching the brake. There is nowadays no need for hand brakes occupying the prominent place they held when they called for a platform for themselves, and we believe it will enhance the safety of train operating if the platforms generally were abolished. With cars closely coupled together there would be much less danger of telescoping than there is with the platform. Many of our worst telescoping accidents have been caused directly by the platform forming a plane over which the adjoining car slid, and smashed up the other. Habit and invested interests are so strong that it will be very difficult to introduce Mr. Merrick's improvement, but we believe that it will eventually come around. In the car which Mr. Merrick has designed steel is very largely used in strengthening the ends and framing. This, of course, would be an advantage to any form of car but it seems to be particularly desirable in the arrangement without platforms

Relations of Railroads to Their Employes.

A very valuable and interesting report has been prepared by Mr. E. A Moseley, Secretary of the Interstate Railroad Commission, on "Relations of Railway Companies and their Employés." It contains brief accounts of the various railroad labor organizations, and gives interesting particulars of the various benevolent associations connected with railroads The extent to which railroad companies interest themselves in the welfare of their employés may be judged from the following extracts, giving the result of inquiries

Out of 350 companies, 59 have an insurance or guarantee fund, or hospital fund, or relief association affording aid in various degrees and ways to employés, is maintaind either by the companies, or by the employés, or by both co-operating on some mutual plan. On the remaining 291 roads nothing of the kind is claimed.

Fifty-two companies provide eating or lodging houses, or meals or lodgings at reduced rates for their employés, and 298 make no provision of this kind.

Seventy-eight companies provide reading-rooms, or some kind of place of resort for their employés, and 272 provide neither Of these, 44 companies have established their reading-rooms in conjunction with the Young Men's Christian Association, by contribution to its fund

Forty-eight companies provide in different modes and degrees for the technical education of their employes, and 302 make no such provisions.

Thirteen companies make distinct provisions for their employés superannuated in their service, and 337 do not The Atlantic & West Point, and the Western Railway of Alabama, pension such employés, and allow them pay without work the same as given them in actual service.

One hundred and twenty-five companies claim that employés disabled by accident are given preference for the performance of other service for which they may be qualified, or that during disability they are provided for in divers ways and degrees at the expense of their respective companies. Two hundred and twenty-five companies make no claim of this sort in any way.

This makes on the whole a fair showing of the interest manifested by railroad companies in the welfare of their employés, but there is still room for improvement. Just think of there still being 225 companies where a disabled employé is cast off like a broken car-wheel, and given no preference in employment for which he is qualified. We once knew of a case of a railroad manager in Scotland who charged the expense of a coffin for her husband out of the insurance money due the widow The accident in which her husband was killed was due to the parsimony of the company. We scarcely think that any of our railroad managers are as mean as this, but those who give a man disabled in their service no consideration do not stand on a much higher plane.

Locomotive Fire-Kindlers.

In 1886 the writer made a tour which took in a large number of the most important engine-houses in the country. Great improvements were noticeable in the conveniences provided for getting the locomotives ready promptly, but everywhere there were complaints heard of the danger, annoyance and inconvenience that resulted from the presence of piles of firewood kept for lighting the fires of the engines. In writing on this subject we remarked

"It appears to us that American ingenuity might devise a method of igniting coal on the grates of locomotives by means of gas or coal oil. On steamers used by the Central Pacific Company coal oil is used as fuel, and the combustible is thrown from jets upon a bed of fire-brick. By a modification of that plan, jets of oil could be injected upon a bed of green coal which would soon ignite from the heat generated by the burning oil. It would not take the exercise of great ingenuity to make jets of gas serve this purpose in places where gas could be readily obtained. We are persuaded that a simple way of starting fires by a safer and cheaper material than wood would fill a long-felt want and prove of great benefit to railroad companies and to the men responsible for getting locomotives steamed up"

This call was promptly responded to, and several patents were shortly afterwards obtained for methods of firing up locomotives by means of oil. The introduction of this improvement has been slow The appliances first tried were not satisfactory, and they had to be changed and simplified to be suitable for use. There are now several practicable fire-kindling devices on the market, and railroad companies are displaying a disposition to adopt them. Already there are several railroad companies in Chicago which have equipped their engine-houses with a fire kindling plant, and a very satisfactory system has been in use in the Wisconsin Central engine-house at Waukesha, for several years. There are now good prospects that the piles of firewood will cease to be a feature of the roundhouse, and that neatness and order will prevail where it was not possible before The fire-kindler is a very simple device and easily imitated Of course, there are railroad companies calling for imitations to save the small expense of royalty We do not know how broad the patents are covering these devices, but we hope they are broad enough to exact royalty from the pirates who have learned how to make a fire-kindling apparatus by studying the patented article.

Leaky Tubes.

At a recent meeting of the Central Railroad Club, a report was read on "Leaky Tubes—the Cause, and how to Prevent it." The principal cause of leaky tubes was said to be bad water and defective circulation. Then was mentioned the prevailing practice of admitting air in a way which causes rapid contraction of the hot metal, and the irregular feeding of the boiler, which produces a similar effect to the injudicious admission of cold air. Recommendations were made that a sufficient thickness of fuel should be maintained in the front of the firebox to prevent cold air entering, and that close-fitting dampers should be employed. The committee also expressed the opinion that workmanship was an important factor in the problem of keeping flues from leaking. We cordially second the expressions in this regard. One matter which the committee did not mention we consider of paramount importance They said nothing about the character of the metal used for making the tubes employed. A discussion on leaky tubes without mention of this point was like hearing the play of "Hamlet" with the Prince of Denmark left out. Some of the roads running into Buffalo, where this discussion took place, are using the worst tubes made in this country, and they are the native manufacture of the State. They are the poorest kind of Bessemer steel, and are sold as charcoal iron The Central Railroad Club would do well to investigate the tube question a little further.

In an interesting discussion about hot boxes which took place at the New England Railroad Club, some curious information was elicited concerning so-called "babbitt" metal. A gentleman who was interested in bearings applied to a great many houses which were supposeed to sell babbitt metal, and he did not find the real metal in any of the specimens bought. It is well known that now-a-days any kind of alloy gets the name of babbitt metal, and some of it is of most inferior quality and very badly adapted for any kind of bearing. It would be a good plan for those who are making alloys to find out exactly what babbitt metal really is There are a great many kinds of inferior metal sent out because cheap mixtures are used, but we have noticed in not a few shops where babbitt metal was made that the method of melting the ingredients had a good deal to do with the inferior quality produced All the ingredients would be put in a crucible together and melted, although the melting point of some of the ingredients would be almost twice as high as that of the others. The consequence is that the metal which melts first evaporates and burns out in a great measure before the other metals are melted The proper way to do this work is to melt each constituent separately and then pour them together When this is done, a metal of the kind required will be produced, but not otherwise.

The English syndicate which purchased the Otis Steel Works appears determined to run the establishment according to English ideas. The representatives of the owners have taken charge, and the old manual forces which made Otis steel the most popular steel for railroad purposes are relegated to the rear. Mr. J. K Bole resigned three months ago, and we are now informed that Mr William Wilson, of Chicago, who might have held the fort, has also resigned. The latest news is that Mr Charles Otis has sold his interests in the company Our English friends evidently are doing their best to ruin the business. They are ignorant of how railroad supply business is mananged in this country, or they would not under any circumstances permit the leviathans of the business to go into other lines of industry.

At the last convention of the Brotherhood of Locomotive Engineers, a change was instituted making the conventions biennial—that is every two years. The first convention under this arrangement will be held at St. Paul, Minn., on May 9. An unusually large attendance is expected. Before the meeting of former conventions there have generally been rumors of war to be waged by one section or clique against others. The atmosphere appears to be surprisingly clear this time, and the indications are that harmony and brotherly love will prevail unless unexpected firebands are thrown into the midst of a somewhat explosive material.

The Traveling Engineers' Association are displaying a great deal of energy in investigating the subjects for which committees have been appointed. During the last month we have received two circulars requiring answers, each of them being remarkably full. One is on "A Uniform Form of Examination of Firemen for Promotion and New Men for Employment," the second is "How can Traveling Engineers Improve the Service when Engines are Double-crewed or Pooled?"

PERSONAL.

Mr Jesse Hall has been appointed train master of the South Western of Georgia, in place of Mr C. L Brunner, transferred.

Mr. F. E. Carey, of the Wisconsin Central, has been appointed chief dispatcher of the Butte, Anaconda & Pacific, at Anaconda, Mont.

Mr H. M. Smith has been appointed general master mechanic of the St. Louis Bridge Terminal Railway, with charge of all machinery

Mr. J. P O'Brien, heretofore superintendent, has been appointed general superintendent of the Iowa Central, with headquarters at Marshalltown, Iowa

Mr. F H. Bleeker has been appointed division superintendent of the St. Louis, Keokuk & North Western, with jurisdiction from North St. Louis to Bellefontaine, Mo.

Mr. J. D Morehead has been appointed master mechanic of the Vandalia Line at Paris, Ill. He was formerly foreman of the roundhouse at Terra Haute, Ind

Mr Rollin H. Wilbur, general superintendent of the Eastern division of the Lehigh Valley, has been transferred to the northern division, with headquarters at Bethlehem, Pa.

Mr. J. J McLaughlin has been appointed superintendent of the Butte, Anaconda & Pacific. He was formerly superintendent of the St Paul division of the Chicago & Great Western.

Mr. E. E. Hudson, master mechanic of the Cleveland-Indianapolis division of the Cleveland, Cincinnati, Chicago & St. Louis, has removed his headquarters from Cleveland to Bellefontaine, O

Mr A J Ball, who recently resigned as master mechanic of the Columbus, Sandusky & Hocking, has been appointed master mechanic of the Ohio Southern, with headquarters at Springfield, Ohio

Mr. Robert Ross, who was murdered at Troy, N. Y., on last election day, was a bright mechanical engineer of much promise He was one of the firm of the Ross Valve Company and held the position of Secretary.

Mr W. G Bailey, engineer of maintenance of way of the Cleveland, Cincinnati, Chicago & St. Louis, at Wabash, Ind, has been appointed superintendent of the Cairo division of that system, with headquarters at Mt. Carmel, Ill.

A lecture was given at Cornell University, Ithaca, N. Y, on March 10th, by Mr. Angus Sinclair. The subject was. "The hard road of self-instruction in engineering" Professor Thurston introduced the lecturer to a large audience

Mr Arthur Crandall, the well-known railroad supply man, has lately associated himself with Mr Johnson, a railroad man of many years' experience, and the firm has made arrangements to manufacture and sell a variety of articles required for railroad rolling stock.

Mr J H. Brown has been appointed to take charge of the Westinghouse air-brake instruction car of the Chesapeake & Ohio Railroad Mr. Brown was formerly an engineer on the Baltimore & Ohio, and is thoroughly competent to perform the duties of air-brake instructor.

Mr. L S Randolph, who was for several years mechanical engineer of the Baltimore & Ohio, at Baltimore, is now pro-

[illegible] engineering of the Agricultural College, Blacksburg, Va. He writes that it will be a long time before he loses his interest in railroad matters.

Mr W. T Reed, superintendent of motive power and rolling stock of the Chicago Great Western, has tendered his resignation to accept it is said, a position on an Eastern road There is talk that he is going to the Canadian Pacific. He was formerly a master mechanic on that road.

In a late issue we mentioned that Mr. [illegible] Boyle had been appointed master [illegible] of the New York, Susquehanna & Western This was a mistake Mr. [illegible] was appointed general foreman at Jersey City On some roads the position [illegible] called master mechanic, hence our mistake

Mr L. P. Ligon has been transferred from East Radford Va to be master mechanic of the Norfolk & Western, at Bluefield W. Va. Mr Ligon is one of the [illegible] cordial friends that Locomotive Engineering has had in the South, and we [illegible] intensely gratified that he has made [illegible] in the march upward

[illegible] pleased to note the steady and [illegible] restoration to health of our old [illegible] J. S. McCann, of the Kansas City, [illegible] Scott & Memphis road There is [illegible] to believe that he will soon [illegible] his former position, and it will no [illegible] pleasure to his old officers and [illegible] to see him back to his post [illegible]

[illegible] Thomas Ramsdell has resigned as [illegible] of the Wisconsin Central, [illegible] Point, Wis., to accept a position [illegible] Topeka & Santa Fé, at [illegible] Madison [illegible] Mr Ramsdell has had [illegible] as pattern-maker, draughtsman, machinist and shop foreman, which [illegible] good equipment for climbing the [illegible] ladder

Mr L. D Sweet, an old Denver & Rio Grande man, has been making a tour of [illegible] cities, exhibiting the Sams automatic car coupler. The coupler is of the link and pin type, exceedingly simple and perfectly automatic Mr. Sweet has received much encouragement from numerous railroad men who have examined the coupler The talk is that the Santa Fé [illegible] will adopt it as standard

Among the pleasant incidents of the season was a banquet given to Mr E. F. [illegible] Davis, general manager of the Richmond Locomotive Works, by the men in the engineering and drawing-room departments About forty men sat down to the feast, which was given to celebrate the successful completion of the engines ordered by the Richmond & Danville Railroad, the work having been done in shorter time than that allowed by the contract, which was unusually short.

A friend in Mexico writes us "Mr J S Turner, who has been acting assistant master mechanic and road foreman on the Mexican International Railroad for the past eighteen months, has tendered his resignation, to take effect March 24th, in order to accept the position of superintendent of motive power on the West Virginia Central & Pittsburgh Railroad. Mr. Turner is a bright mechanic and a practical roadman, and he leaves Mexico with the best wishes of his many friends for his future success."

Mr John A. Hill, the J. P , as he calls himself of Locomotive Engineering, has gone away upon a Southern trip which will extend as far as the City of Mexico. He started out carrying two satchels, a photographic camera, two boxes of cigars and a load of native modesty We commend our Junior to the tender mercies of his friends He threatened to brush up his acquaintance with life in the cab, but he will be better in a chair car Engine riding is wearing on a man who has been away from it for several years, and John has a 5,000-mile tour ahead of him.

Mr L. B. Laurence, who died at Paterson, N. J., last month, was an inventive genius of remarkable ability, whose talents were wasted for want of worldly-wise attributes. He was a Dane by birth, and in his youth was a lieutenant in the King's guards He was brought to this country by the late Commodore Garrison, who engaged him to invent mechanical appliances for railroads, and to act as an advisor on engineering matters. Like many foreigners, he did not readily grasp the conditions of railroad operating in America, and the inventions he perfected were not appreciated.

Mr W H. Rosing has been appointed master of the Denver division of the Denver & Rio Grande, with charge of the shops at Burnham, Col Mr. Rosing is a mechanical engineer of decided leading ability. He has been for several years a master mechanic on the Illinois Central, and rose from the position of chief draughtsman He was for a time mechanical engineer of the Grant Locomotive Works, at Chicago, and got those works in working order He combines in a remarkable degree theoretical education with the dictates of a wide, practical experience

The following personal changes have been made on the Erie system, brought about by the promotion of Mr. W. Lavery to be assistant superintendent of motive power Mr B. Clark, who has been foreman of the car shops of the New York Lake Erie & Western, at Buffalo, N Y., has been appointed mechanical engineer, with headquarters at Susquehanna, Pa , in place of Mr. F. N. Hibbetts who has been appointed master mechanic at Rochester, N Y , Mr. C. P. Weiss, heretofore master mechanic at Rochester, has been appointed master mechanic at Hornellsville, N. Y., to succeed Mr J Bond, transferred to Susquehanna, Pa.

Mr Wm W Adams, general storekeeper of the Fall Brook Railway Co., was, on the 6th of March, elected Mayor of the City of Corning, N Y., over Harry H. Pratt, one of the editors of the Corning *Daily Journal*. The municipal contest was the most closely contested in the city's history, but the principles involved and the personal worthiness of the candidate brought Mr Adams in a winner by the neat majority of 225. Although comparatively young, Mr Adams has been in the service of the Fall Brook for thirty years, and the position of honor to which he is now called is deserved and recognized, not only by his townsmen at large, but also by his railroad intimates and acquaintances.

Recent advices from Florida give us the gratifying intelligence that Mr C E. Smart, S M. P of the Michigan Central Ry. Co., who has been ill for some three months, is rapidly recovering and will, no doubt, be fully restored to health if great care is taken to ward off a relapse. The danger of this comes from a natural desire on his part to be at his post of duty. The exceptionally fine treatment received by Mr. Smart from President Ledyard and General Superintendent Robert Miller, in forcing upon him a private car, fully equipped to make him comfortable, with transportation to wherever health could be found, and insisting that he must go and stay until fully restored to health, is one of those striking and beautiful evidences of appreciation of service faithfully rendered.

Mr Thomas Midelton, a well-known mechanical engineer and locomotive superintendent, died in New South Wales, in February last. He was for some years locomotive superintendent of the New South Wales Railroad, and was noted there for the favor he showed to the American type of locomotive In fact, he had made very close investigation of the relative merits of English and American locomotives' work in the colony, and although an Englishman himself, he decided that the American locomotive was the better suited for their work, and he designed a class of locomotives conforming very closely to American practice This brought him many enemies in New South Wales and in England, and led to his discharge about four years ago. He was a member of the American Railway Master Mechanics' Association and took great interest in the proceedings.

An order has been issued by President Vreeland, of the Metropolitan Street Railway Co., New York, appointing Mr. Thomas Millen general master mechanic of the company. Mr. Millen resigned the position of superintendent and master mechanic of the New York & Northern to accept this place Mr Millen is one of the hard-working class of railroad men, who are always attending to their business early and late, and who make themselves a necessity with the company they serve There is no fuss, no pretension, but when men like Friend Millen leave a job, it takes about three men to fill the opening they have left behind them. We have no idea what inducements the street railroad company have offered to draw Millen from his surface railroad loves, but we feel disappointed that the latter interests have lost such a good man. But, then, Vreeland has gone from our good stamping ground, and he appears to have no remorse of conscience in advising other good men to do likewise.

The following extracts from a letter written to the S. P. by Mrs. George W. McGuire, of Cleveland, will be welcome reading to many of our friends "I know you will rejoice with me when I tell you that George is going to come off victor in his battle with the grim tyrant, and that the doctor assures us that in a year's time, or may be less, he will be as well as he ever was in his life. It is truly marvellous the gain he has made in nine weeks in the hospital. The aneurism has already abated fully one half in size . . The doctor has arranged for him to see a gentleman friend once a week. He never utters a complaint, but is watching his own case and trying all he can to reduce his pulse down. I take him Locomotive Engineering, and after he reads it thoroughly he sends it into the railroad ward of the hospital The orderly says that one man will read aloud to the others and the paper is passed around They have many discussions over its contents George says could Mr. Sinclair and Mr. Hill hear the many complimentary remarks made they would feel highly pleased, for the praise is genuine

A Tube Story with a Moral.

Any railroad man interested in the quality of boiler tubes could receive a good object lesson by calling at the office of Mr. A E Mitchell, superintendent of motive power of the Erie. The officers of this department follow a practice when they receive a delivery of flue tubes of drawing the ends of some of them down thin, the work of course being done cold. In Mr. Mitchell's office is a piece of tube that had been treated in this way. The end is split so uniformly that the material looks like fine wire ends. The tube is steel and very poor steel at that. It is no wonder that flue setters have trouble beading tubes when the material is of this inferior quality. This was a cheap make of tube offered to the Erie as a means of reducing expenses The company are sensible enough to decline attempting to reduce expenses by employing inferior material in places where it would be likely to prove troublesome. We think that boiler tubes and boiler material generally should be among the last things for railroad companies to inflict the cheapening process upon.

We have in mind the remembrance of an instance where a purchasing agent cheapened an important part of a locomotive boiler, and the result was of a kind to point a moral and adorn a tale. The company were using brick arches supported by water tubes, and there had been great difficulty in getting the tubes to stand, as there was considerable impurity in the feed water. One day the maker of a remarkably good quality of boiler tube called on the master mechanic of the road soliciting business. He was told that the boiler tubes which the road was using were satisfactory, but that the tubes used to support the brick arch did not last more than three or four months. The tube maker at once volunteered to supply tubes for this purpose, and said that he would make no charge if the tubes did not last two years. His offer was jumped at When put in service the tubes proved as good as they had been represented to be ; but they were high priced, the charge being about 15 cents a pound They lasted so well, however, that they were very cheap compared to the tubes previously used when the service performed was considered.

It came to pass that the purchasing agent of this road died, and a successor was appointed who immediately began to try and make a record. One of his first discoveries was that the company had been paying a high price for brick arch tubes This must be reformed instanter. He told the tube maker that his price was absurdly high, and that it must be cut in two or the company would buy no more of that kind of tube. Strained relations ensued, and the purchasing agent ordered tubes from a firm in New York State that undertook to make an article suitable for the purpose A double steel flue was supplied. This had not been long in a firebox when one of them bursted and scalded a fireman to death, This purchasing agent was morally responsible for the man's death, but he was not put on trial The company is again buying the first-class iron tube at an increased price. The moral is that nasty cheapness is expensive policy in the end.

An intimation has been sent to us that Mr. George Richards, Suffolk House, Laurence Pountney Hill, London, England, has established an agency for introducing American patents and manufactures into England. Mr. Richards is a well-known mechanical and consulting engineer who went from this country to England to establish the manufacture of American tools in that country He is thoroughly reliable in every way, and persons who wish to introduce patented articles to the notice of English manufacturers can safely apply to Mr Richards for assistance and information

The Chicago & Northwestern mechanical department are using a soda compound to soften the feed water, and it is reported to give very satisfactory results. The mixture is similar to that employed by the Chicago, Milwaukee & St Paul, the recipe for which was prepared by Mr. George Gibbs, the mechanical engineer. The use of this mixture appears to be a very profitable investment, for it keeps the heating surface fairly clean, reduces thereby the amount of boiler work to be done, keeps the engines longer in service between the periods of going in for repairs, and saves enough fuel to pay the expense of the compound.

In the course of a private letter from Mr. George Royal, Jr , he says "In the March issue of Locomotive Engineering you speak of steam from air pump being used for heating of trains in a foreign country. I might say that at Omaha, the Union Pacific now have several engines fitted in this manner The writer was in Omaha a week ago, and Mr. J. H Manning, master mechanic, spoke favorably of the attachment, and I believe is fitting out other engines. It is arranged with a valve so that on failure of the pump to supply steam, live steam from the boiler can be used."

EQUIPMENT NOTES.

The Armour Refrigerator Co. have ordered fifty more refrigerator cars from Wells-French.

The Valley Road of Ohio have ordered two ten-wheel locomotives from the Pittsburgh Locomotive Works.

A highly promising improvement in piston-rod packing has been patented by Thomas J. Hudders, St. Paul, Minn.

The Florida Central & Pe. Co. have under advisement the purchase of some additional power and cars, for next winter's business.

The Jackson & Sharp Co., of Wilmington, Del., have an order for forty milk cars from a Philadelphia dairy company, to be run on the Lehigh Valley road.

The Mason Regulator Co. of Boston, are sending out, as advertising, a neat set of dominoes. They offer to send them to anyone who will send 12 cents for return postage.

The Fitchburg Railroad Company have given orders for 100 cars to be built at their shops at Fitchburg, for the purpose of giving employment to the men out of work in the town.

The Haskell & Barker Car Works are reported to have secured a contract for 1,500 cars, and the plant at Michigan City, Ind., will resume operations after six months of idleness.

A car-brake adjuster has been patented by James Howard, of New York, the well-known expert on train-brake mechanism. It is a ratchet arrangement and is of extremely simple design.

The Swartzschild & Sulsberger Packing Co. have ordered fifty refrigerator cars from the Missouri Car & Foundry Co. The cars are to be completed and delivered in Kansas City by May 1st.

The South Jersey Railroad Co. have awarded a contract to Harlan & Hollingsworth, of Wilmington, Del., for the construction of twenty-five passenger coaches, to be completed by May 15th.

The Schenectady Locomotive Works have just completed for the New York Central & Hudson River road a locomotive numbered 888, similar to the famous 999, and another will soon be built.

The shops of the Pennsylvania, at Columbus, O., have recently completed an order for passenger day cars for the Cincinnati & Muskingum Valley, to replace the old passenger equipment of that road.

A railroad in Japan has ordered four locomotives to be purchased from American makers. They will be six-wheel coupled tank engines, weighing about forty tons. There is a good deal of competition to fill the order.

The shops of the Southern Pacific, at Sacramento, Cal., are now building 150 refrigerator fruit cars. Oregon pine is to be used for the construction of the cars, and the work will be done by the piece-work system.

A disastrous explosion happened near Muncie, Ind., last month to the boiler of the mogul locomotive belonging to the C., C., C. & St. L. The fireman was killed and the engineer and head brakeman severely injured.

The Vandalia Line have some engines with underhung driving-wheel springs, of the Pittsburgh Locomotive Works arrangement, which are reported to give better satisfaction than anything that has ever been tried upon the road.

The Sanford & St. Petersburg R. R., formerly the Orange Belt, will build during the year at their Oakland shops some thirty box cars. They have recently purchased two engines—N. G.—from the Denver & Rio Grande R. R.

The Metropolitan Elevated Railroad of Chicago have decided to begin operating with locomotives. They talked of electricity, but no satisfactory guarantee could be obtained. They have ordered 100 passenger cars from Pullman.

The Mexico, Cuernavaca & Pacific R. R. of Mexico, is having four passenger cars built by the Jackson & Sharp Co., at Wilmington, Del. The company will soon place an order for fifty freight cars and two large 10 wheel freight locomotives.

The order for locomotives which the New York, Susquehanna & Western has been considering for some time, has gone to Rogers. They consist of one passenger engine, two moguls and one consolidation. The freight engines will have Wootten fireboxes.

On the fifth day of May next the Antwerp International Exhibition will be opened. American manufacturers desirous of exhibiting at that fair should lose no time in applying to Mr. T. A. Matthews, No. 16 Church Street, New York, for particulars about space, concessions, etc.

The Long Island Railroad Company have a firebox of Spang steel in one of their engines, and it is nearly ready for removal, although it has been in only about eighteen months. It is cracked badly from the stay-bolts, and it will be hard work getting it to stand out all summer. Good steel fireboxes stand on that road an average of five years.

Mr. Chas. F. Winby, inventor of the four-cylinder engine, "James Toleman," recently shown at the Fair, has been watching her performance on the C., M. & St. P. Her eccentrics ran hot, and Mr. Winby tried a pair of Bangs' oilers on them; these did so well that he ordered cups for the entire engine, and has secured the right to manufacture them in Great Britain.

Business on the Western R. R. of Ala. & West Point Road has an encouraging outlook. Few roads in the South are better equipped to do the business that may be offered. Road-bed and equipment is thoroughly first class, and the discipline of the men in all departments is of a highly satisfactory character. Capt. Tyler has the fullest possible confidence in his men, which is well deserved.

The Orange Belt Railway of Florida appears to have a very efficient master mechanic in Mr. J. F. Sheahan. We have lately been looking over the performance sheets of the locomotives, and comparing them with other roads in the same vicinity. The expenses for supplies and repairs are very low compared with other roads doing similar work. The total cost per mile run is below seven cents, the repairs being only about one cent per mile.

We are informed that the Gates Iron Works, of Chicago, manufacturers of the famous rock and ore crushers, have recently purchased the entire plant of the Chicago Iron Works. This consists of buildings, tools, machinery, stock, patterns, drawings, etc. This will greatly add to the facilities of the Gates Iron Works Co., although they previously had the best facilities for manufacturing their own style of machinery that were to be found anywhere.

We have received from Henry C. Ayer & Gleason Co., of Philadelphia, a number of sheets showing illustrations of the tools which they are making. Among these tools we find Gleason's instantaneous positive vise, the same designer's automatic fac-simile lathe and his original ratchet drill. Besides these there are several appliances suitable for hoisting in railroad shops and similar places. Any persons needing tools of this kind would do well to send for circulars.

We are informed by Mr. F. H. Brackett, Brattleboro, Vt., that he is making a small screw jack for holding up the equalizer while a new spring is being put in. From a sketch of the jack which we have received we should conclude that it is a very useful tool and one likely to be very convenient on a locomotive. Tools of the kind are often made for the use of engineers by friendly machinists. Those who cannot get it made readily ought to send for this one, which can be bought for $1.50.

A patent has been granted to Mr. James McNaughton, superintendent of motive power of the Wisconsin Central, for a locomotive fire-kindling device which he has had in use in the engine house at Waukesha for about a year. It is a highly practical fire-kindler, is perfectly safe and does the work at very small expense. We understand that the cost of firing-up an engine with it is about six cents. Mr. J. S. Leslie, well known for his connection with the rotary snow plow, is handling McNaughton's fire-kindler.

The Long Island Railroad people are introducing brass eccentric straps and brass driving-boxes as a remedy for the breakage so common when these parts are made of cast iron. They make the driving-boxes in a mold, and do the work so accurately that the boxes are put under the engines without any machine work being done upon them. All the work found necessary is to clean the casting a little and sweat a soft lining upon the bearing. With this little care they start off and run perfectly cool.

The mechanical department of the Pennsylvania railroad at Altoona are getting out new drawings of the class P locomotive, with the intention of making radical changes on the design. They took a very sensible and practical way to obtain data for making the required changes. All the master mechanics were invited to criticise the old engine and note down what changes they would recommend as being likely to improve the engine. The opinions were expressed very freely, and the best of the changes suggested are embraced in the new design.

The Builders' Iron Foundry, Providence, R. I., have just published a new edition of their catalogue of globe special castings. These castings are used by a great many railroad companies and are in high favor. The business policy of the makers of these castings may be judged from an introductory note to the catalogue. The ancient founder is heard to remark: "We make specials as long as we can and as heavy as we can; our business is to sell iron." As a contrast to this the Builders' Iron Foundry state their policy to be: "We make specials as compact as we can, as light as we can; we utilize every pound of metal. Our business is to sell globe specials."

After having the Fox pressed steel truck in use for several years the New York Central people are very highly pleased with its performance. The truck runs month after month without requiring any repairs. The criticism was made upon it that the rivets would soon get loose, and that it would be more costly to keep in running order than the diamond truck. Experience has shown this fear to be groundless. There is no more reason why the rivets in a truck should work loose than those of a bridge should get in that condition, and there is no trouble with riveted bridges. There is good reason for believing that the New York Central will make the Fox truck their standard for freight cars.

The Mt. Vernon Car Mfg. Co. secured an order from the Mobile & Ohio Railroad for 100 of their standard improved ventilated combination fruit and refrigerator cars. Cars to be 60,000 pounds capacity, equipped with air-brakes and Carson & Gurganus air-tight door. This is the combination fruit and refrigerator car that has attracted so much attention among railroad men in the last year, the car being especially adapted for shipping bananas and oranges from southern points to the extreme North without transferring, and a car that can be used both in summer and winter. A representative of the company writing about this order says: "Business is very dull at this time, and 100 cars look as big as 1,000 would in ordinary times," say the builders. "We have been very fortunate, however, having only been shut down for a couple of weeks. Have been running full time all summer and winter until about two weeks ago."

An improvement in car trucks, invented by Mr. William Voss, superintendent of the Barney & Smith Company's Works, has been patented. It is described as a car truck, having one or more series of half elliptic springs rigidly secured at or near their centers, alternately to the car body and truck frame, the springs being so linked together and their ends so connected with the car body or truck frame as to permit all the springs to yield freely to the inclination of the car body and truck. By means of this arrangement the weight is practically uniformly distributed over all the springs, imparting an easy movement to the car and securing a uniform distribution of the strains.

The Jacksonville, St. Augustine & Indian River R. R., with many others throughout the country, shares in the depression so generally prevailing. Their equipment, however, is maintained in that highly efficient condition which has accorded to it, most justly, the title "gilt edged" of the South. The little ornamental features which have marked this equipment in the past has been one of the best possible investments for the company in building up a reputation for genuine excellence and attracting travel, and furnishing its patrons comforts and enjoyments not given by other roads. The actual first cost and maintenance of these ornamental features is so insignificant that it is naturally a source of wonder why other roads do not attempt something in this line. To the traveler of experience in the railway field one is quickly impressed with a deficiency, in the operating department. Many little things in this department force themselves upon your attention. They cannot be specified in a convincing manner without the use of more space than we can well allow.

The Central Railroad of Georgia, under the general supervision of Capt. T. D. Kline, is rapidly regaining its former prestige, at one time seemingly hopelessly lost by wretched management under amateur managers—it being blessed or cursed with three successive reigns of this class, each one of which seemed to sink it deeper in the condition from which it seemed impossible to raise it. Capt. Kline left the property some seven years since, when it was rated as one of the best of Southern roads. None stood higher in the North or the South. What a revelation it must have been to him to find it in a forlorn condition that can hardly be described. The task that confronts him is one that would make the ordinary type of man hesitate. It will cost him, or any man, to accomplish its restoration ten years of his life in money and hard work for which he can never be adequately compensated. His knowledge of the four departments and his all-around experience alone can bring about this restoration to its old condition. The *specialists* have wrecked it, as they have wrecked many other equally good properties.

Some "Dont's" for Young Engineers and Firemen.

An engineer, writing over the signature Improvement," sends in this chapter of Dont's," dedicated to young men on the road. They are good

Don't think, after you have fired or run a year, that there is no room for improvement—there is plenty of room, as you will find out.

Don't think because the M M. or R F. "jacks you up" that he "has it in for you" perhaps you are getting careless and need your "packing set out," we all do once in a while. Keep up your rods and wedges, everything neat and clean, especially in the cab, always be punctual and your "packing won't blow"

Don't think because the boys on the "247" are lighter on coal, oil and supplies than you are that it is bound to be the fault of the "248"—it may be yours.

Don't forget to put your fire in *before* pulling out, and enough to last till he hooks her up—she will steam easier and be lighter on coal

Don't forget to keep your front damper shut, especially if the coal is very coarse, as it lets in too much air, and you will have to fire heavier There are exceptions to this rule.

Don't forget, if you are on a hard run and coal is lumpy, to call R. F.'s attention to it. It is easier broken by the men in the shed, and if you explain why, the R. F will have it broken for you (?)

Don't forget, when oiling, to run oil can clear around shoes and wedges, you can then run them tighter than your neighbor who only oils "in sight," and your wedges won't stick.

Don't neglect to keep oil holes clean, and use a little headlight oil in them once in a while, it cuts the gum and she will handle easier. Drop a little oil between boxes and hubs, and have less lateral motion

Don't be spasmodic or jerky with anything, be swift but "aisy," smooth and collected, your machinery will wear better and you will get a good name Be at home

Don't be afraid to ask your engineer questions, if he don't know, it is a good time to learn

Don't be ashamed to read mechanical books and papers, especially LOCOMOTIVE ENGINEERING. Theory and practice are side-partners.

Don't lose your temper when you get delayed on the road, and cuss the dispatcher, it is just as important for him to tend to business as you, and—perhaps you don't rustle

Don't forget or be afraid to read your orders to the fireman and brakeman, they may save your job, your life, or a wreck. We are none of us infallible by any means.

Don't think because you work for a company that takes no interest in your work, that these "don'ts" are no good. You may get on a good road some day.

Don't let her pop or slip, or work water, or pound, or get dirty, any more than you can possibly help. She will last longer, run cheaper, and give better service, if you are careful.

Don't talk across the boiler-head on a switch engine

Don't get cross, ugly, or cranky because they did not reduce the "left back end" or because things don't go just right. It is the clouds and shadows of life that make us appreciate the sunshine. We all have our share of both

Don't forget to be pleasant with the whole crew. Kind words don't cost anything, and the trip will be pleasanter.

Don't, when starting out late, try to make up all the time in ten miles. Make up a little all the way over the division, it will look better and be easier on the boy at the scoop.

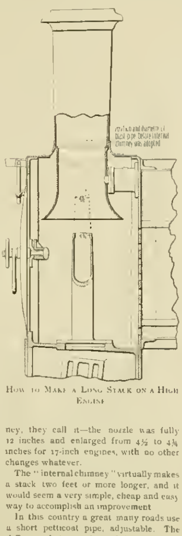
Don't turn your good air-pump wide open, and depend on the governor to shut it off. Run it as slowly as possible always, let it work constantly, and use very little oil (except on swab), and it will last years.

Improvement of a Short Smokebox.

The diagram on this page was taken from a drawing sent to a committee of the Master Mechanics Association by Mr. F. W. Webb, mechanical superintendent of the London & Northwestern Railroad.

The front ends in use in Great Britain are universally short, and most of them are devoid of netting or deflector plates The former practice on this road was a plain open stack with a very high single nozzle.

After the adoption of the extension of the smokestack in the arch—internal chimney, they call it—the nozzle was fully 12 inches and enlarged from 4½ to 4¾ inches for 17-inch engines, with no other changes whatever.



HOW TO MAKE A LONG STACK ON A HIGH ENGINE

The "internal chimney" virtually makes a stack two feet or more longer, and it would seem a very simple, cheap and easy way to accomplish an improvement

In this country a great many roads use a short petticoat pipe, adjustable. The difference between this and the one shown being that the latter is tight at its junction with the stack and is a permanent fixture—a part of the stack

Mr. Webb makes this extension of cast iron.

It looks to us as if this would be an improvement on some of our big and high engines, where the smokestack looks as much like a plug hat as a chimney

Long Island Shops.

The repair shops of the Long Island Railroad, at Morris Park, L. I., are the only railroad shops in the neighborhood of New York that have been working full time all winter. The origin of this highly satisfactory state of affairs is that the company are applying the Westinghouse air-brakes to the locomotives and cars and making numerous improvements on the passenger equipment. They are converting the passenger cars that had side doors and cross seats like summer street cars into platform cars with end doors and aisles This change was recommended by the Railroad Commissioners after the tunnel accident last summer when so many people who were hanging on the outside of the cars were killed

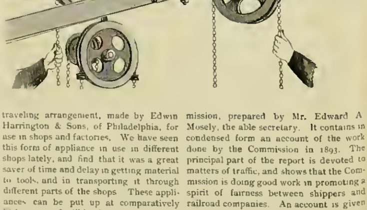
While applying the air-brake for the first time to a great many of the cars, Mr S. F Prince, master mechanic, has been devoting close attention to the sliding of wheels, and he finds that with some shoes 90 per cent. of the light weight will cause sliding frequently, while with shoes of other material there is no sliding or even defective braking. His observations appear to show that one of the greatest needs of the day is a uniform mixture for brake shoes The company has a large number of Lapham shoes, and they appear to be favorites beyond all others. Some of the divisions of this road are very sandy and particularly hard on brake shoes. A set of soft cast-iron shoes will be worn out in going to the end of the line and back

The shops at Morris Park have been in use only about four years, but they are already too small for the work to be done. Important additions have been made to the machine tools, and the probability is that still more tools will be ordered soon. They have in use here a tool not often seen in railroad shops, which is very highly spoken of. This a Nicholson stay-bolt cutter, with six heads. It is much more efficient than the ordinary bolt cutter, and turns out a great many stay-bolts with the threads properly cut.

Where Bessemer steel is employed in the making of steel castings extraordinary care is exercised to make the product as nearly uniform as possible During the blow an expert watches the varying color of the flame, and by the aid of a spectroscope determines if the elementary gases are passing off in the manner desired. Experience has led to the curious discovery that it is desirable to prevent the silicon from passing out much before the carbon gases are burned by the blast. In case that the silicon is eliminated before the carbon the product will not differ materially in chemical analysis, and yet the steel will not be so good as it is when a fair percentage of the silicon is held till near the end of the blow. It is not very clear how this is so. It may be that the silicon prevents oxydation, but this is by no means certain. There are things in heaven and earth not known to our philosophy.

Harrington's Hoist and Traveler.

The annexed illustration shows a very simple and efficient form of hoisting and



traveling arrangement, made by Edwin Harrington & Sons, of Philadelphia, for use in shops and factories. We have seen this form of appliance in use in different shops lately, and find that it was a great saver of time and delay in getting material to tools, and in transporting it through different parts of the shops These appliances can be put up at comparatively little cost, and will be found of very great service in places where overhead traveling cranes are not available. Parties wishing to equip their shops with this form of labor-saving device should apply to the manufacturers for particulars concerning it.

Efficiency of Ratchet and Pneumatic Jacks.

Mr. S Bean, master mechanic of the Northern Pacific, sends us the following comparative statement of cost of putting freight cars upon horses and replacing same upon trucks with ratchet jacks and with the pneumatic jacks

Five cars, after having outside brake beams removed, were put on horses by two men with ratchet jacks in one hour.

Cost of labor, 2 hours, at 20c. per hour.	$0 40
Replacing cars upon trucks, 2 hours, at 20c. per hour....	40
Cost of removing cars to horses and replacing upon trucks. . .	$0 80

Five cars, after having outside brake beams removed, were put on horses by two men with pneumatic jacks in fifteen minutes.

Cost of labor, ½ hour, at 20c. per hour.	$0 10
Replacing cars upon trucks, ½ hour, at 20c. per hour	10
Cost of removing cars to horses and replacing upon trucks.	20

Amount saved upon five cars by using pneumatic jacks.	$0 60
Average cost per car to remove from trucks to horses and replace same with ratchet jacks	$0 16
Average cost per car to remove from trucks to horses and replace same with pneumatic jacks	04
Net saving of labor per car	12

Amount of labor saved on 500 cars by using pneumatic jacks over ratchet jacks, $60.00

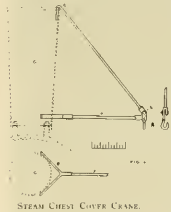
A bad smash was reported to have been caused on the Pan Handle road last month through the engineer falling asleep. The *Railway Age*, with its usual love for railroad employés, asks if this accident would have happened had the easy cab seat been abolished? To us a much more pertinent question is, How long was the engineer on duty?

We have received the Seventh Annual Report of the Interstate Commerce Commission, prepared by Mr. Edward A Mosely, the able secretary. It contains in condensed form an account of the work done by the Commission in 1893. The principal part of the report is devoted to matters of traffic, and shows that the Commission is doing good work in promoting a spirit of fairness between shippers and railroad companies. An account is given of the work done towards promoting the use of safety appliances. This part says that the most hazardous employment is that of trainmen. In the year under review, one out of every nine persons employed in this service was either killed or injured.

Crane for Handling Chest Covers.—A Tube-Hole Cutter.

BY F. M ARTHUR.

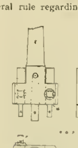
For properly handling steam-chests and covers a rope hoist is very desirable. In some shops provision is made overhead, by means of timbers properly placed for the attachment of the hoist, but in many no such arrangement is made. In such cases and for use in the roundhouse a crane, similar to that shown in Fig. 1, is quite useful. Referring to the drawing, the hook on the upper end of the rod *C*



STEAM CHEST COVER CRANE.

should be so shaped as to clear the ornamental head on the stack that is used on some roads. The lower rod *F* is made with a V-shaped end so as to give a good support against the stack, and where different sized stacks are used this arrangement will be found better than a circular bearing against the stack. The pin *E* is raised above the level of the rod *F* so as to allow the crane to be folded together, making it more convenient to handle. The arrangement of the hook for fastening the hoist too is fully shown in the drawing.

In Fig. 2 is shown a tube-hole cutter. The general rule regarding such cutters



has been to make them solid with two or three cutting edges. The great objection to that style of cutter is, that they can only be used for one size, and when one cutting edge breaks the tool must be annealed and refitted, making in fact an entire new tool except the taper fit for the drill press. Often too, the center tit cuts fast in the hole for want of oil, and breaks off. The tool shown in Fig. 2 will be found to be free from all the objections and possess some good points. It is not expensive, costing very little more than one of the solid tools, it can be used for different size holes by simply providing different sets of cutters, if a cutter breaks off it can be replaced at very little cost. The center tit *B* can be taken out and refitted or replaced by another size. In fitting up this tool it would be advisable to turn up a half dozen cutters, so that no delay would be occasioned should a breakage occur. The cutters are made of ½-inch square steel, and fit to the hole neatly, and secured by a setscrew *F*. The upper edge of the cutter at *H* should be turned so it will neatly round off the edge of the hole and thus avoid going over the work with another tool. By throwing the cutting edges *A* either toward or from the center, the cutting circle of the tool can be decreased or increased. The center tit *B* is fitted to the tool with the same taper as a lathe center, and can be removed with a small drift driven in the hole at the top, as shown. By using a tit as shown at *B* instead of a sharp center, better and more accurate work can be done. This will of course necessitate putting small holes, ⅜-in. or more in diameter, in the center of each tube hole to receive the tit which acts as a guide for the cutter. The taper fitted in the drill press should be secured with a setscrew through the spindle, so as to prevent the tool from dropping out and catching when it is just cutting through the sheet. The flat end usually made on the end of the taper fitted as on a twist drill will hardly be strong enough to drive this cutter.

Savannah, Ga.

A Deceptive Landmark.

A Western railroad man relates the particulars of a trying experience he had during a visit to New York City. He was stopping at a hotel up-town near the Sixth Avenue Elevated Railroad, and knew his way about in the neighborhood of the hotel. It was necessary for him to go down town, and in leaving the railroad he looked about for some landmark which would tell him the station. A pair of huge pumpkins was seen at the door of a seed store, and these looked so familiar and homelike that they were naturally used to establish the landmark

The Western man went about visiting the sights at the lower part of the city, and night was falling when he proceeded towards the street where the friendly pumpkins were to indicate the station he must start from. To his consternation the pumpkins had disappeared. He wandered up and down the street, cursing the storekeeper who would deceive rustic strangers by taking in the prominent landmarks, but at last he decided to take one of the elevated roads. In due time he came to a station on the street where his hotel was located and got off. But the surroundings were totally different. He was on the wrong avenue but did not know it. After wandering about for an hour, getting more and more puzzled, he met a polite stranger who offered to show him the way. The way shown led to an establishment where gambling was going on, and the innocent railroader was invited to try his luck. His answer was to knock down the polite stranger and make for the street. Luckily for him he got there without mishap, and happening to find a cab at the door drove to his hotel. He tells people visiting cities never to use a pumpkin for a landmark.

An Early Promoter of Railroads.

One of the most persistent advocates of improved methods of transportation for New England in the pre-railroad days was Samuel Whitcomb, of Boston. In 1821 Mr. Whitcomb made a journey from New England through Pennsylvania and Ohio, and back through New York State, and his attention was greatly devoted to what other communities were doing to improve their means of intercommunication. He was greatly impressed with the advantages which New York was deriving from the Erie Canal, and endeavored to prevail upon the people of New England to construct a canal from Boston to the Hudson River near Albany. In articles which he wrote advocating this enterprise, he said that the earnings of the Erie Canal would soon be sufficient to pay the whole of the expenses for the government of New York State, and that all taxes would be abolished.

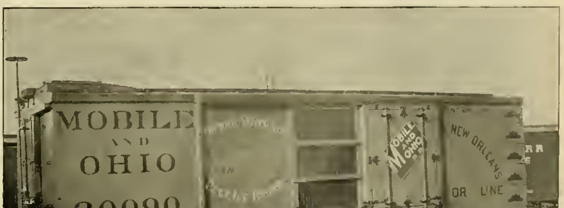
The project of building a canal from Boston harbor to the Connecticut River and thence to the West had taken active shape as early as 1792, but nothing had been done beyond a few preliminary surveys. The persistent efforts of Mr Whitcomb put new life into this half-forgotten scheme, and there seemed prospects of the State of Massachusetts pushing it through. But money was hard to raise, and nothing was done. Then talk of the advantages of railroads came up. The people about Boston had an object lesson in the working of a short railway in connection with the Quincy quarries, and the most progressive men saw in that a means of transportation superior to canals, as a railroad would not freeze up in winter. Mr Whitcomb was converted to the railroad idea and labored to have a railroad built over the route on which the canal was projected. He lived to see the first link in the chain which bound Boston to Albany by rail finished. This was the Boston & Worcester Railroad.

Mr. W. W. Whitcomb, President of the Safety-brake Shoe Company, of Boston, is a son of the man who took such an active part in improving the transportation facilities of New England

An Enterprising Firm.

We are informed that Westinghouse, Church, Kerr & Co., have removed their New York office to the Havemeyer Building. This is one of the largest engineering concerns in the country, having built up a large and profitable business by doing things that had not been done before. To create new things, prove them, and make others appreciate them, involves a factor in progress which does not always meet proper reward, but this concern has seemed to combine the necessary engineering and business qualities to make it pay in the present tense. All the members of the present firm are accomplished engineers and good business men, which is, no doubt, the secret of their substantial success. In the promotion of the interests of subdivided power they were the earliest and strongest advocates. Their success in this class of practice resulted chiefly from not overdoing it. In the revolution from simple to compound engines, this firm had hundreds of compound engines running before the engine-building class was fairly alive to the demand. They have taken the lead in supplying mechanical stoking and other improved forms of firing. Their last special extension in engineering is in refrigeration and ice-making. Starting with an excellent and simple form of compressor and condenser, they have introduced various improvements in the methods of constructing refrigerating plants, and perfected a new, radical and almost revolutionary process of manufacturing artificial ice.

A new locomotive crane has been patented by William Sellers & Co., of Philadelphia. It consists of a boiler and engine with a hoisting and propelling apparatus. The crane rests upon a truck intended to move upon a track, the means being provided for self-propulsion. The crane looks as if it would be a highly convenient apparatus to have about a railroad shop where there are heavy weights to lift in places that cannot be reached by stationary cranes.



CARS THE MOUNT VERNON CAR WORKS ARE BUILDING.

The first work of importance that has fallen upon Mr S. Higgins as superintendent of motive power of the Lehigh Valley Railroad has been the classifying of the locomotives. It is said that he has found over 100 different kinds of engines among the 660 owned by the road. The work of reducing these to a few standards will be very great, but it will be a good thing for the company when the work is done. It would be an interesting operation to examine the multitude of patterns which must be carried to suit the diverse forms of the great variety of locomotives in use.

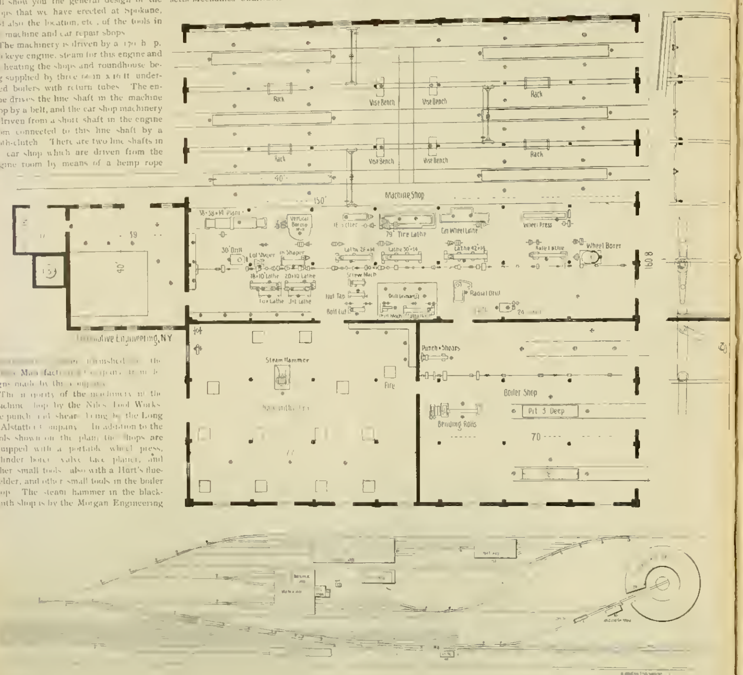
On the N. Y., O. & W. recently a freight car came into a terminal station minus one truck, the crew not knowing it was gone, one end of the car riding on the link alone. The car had run in this condition some ten miles. The truck was found, badly broken, down the bank, pieces of it being strung along the track for a long distance. The truck jumped the track at a switch some distance from where it was found, but it is not known what caused the jump, unless a brake-beam came down, a pair of shoes being found at this point that belonged to the company owning the car.

Great Northern Spokane Shops.

The railroad repair shops shown in the annexed engravings have been erected by the Great Northern Railroad at Spokane, Wash. The shops are particularly well designed, the work having been done to carry out the views of Mr. J. O. Pattee, superintendent of motive power.

Mr. Pattee, in writing to us about the shops, says: "I send you blue prints which will show you the general design of the shops that we have erected at Spokane, and also the location, etc., of the tools in the machine and car repair shops.

"The machinery is driven by a 170 h. p. Buckeye engine, steam for this engine and for heating the shops and roundhouse being supplied by three 54 in. x 16 ft. under-fired boilers with return tubes. The engine drives the line shaft in the machine shop by a belt, and the car shop machinery is driven from a short shaft in the engine room connected to this line shaft by a friction-clutch. There are two line shafts in the car shop which are driven from the engine room by means of a hemp rope



[illegible] furnished [illegible] the [illegible] Manufacturing Company, from designs made by the company.

"The majority of the machines in the machine shop by the Niles Tool Works, the punch and shear being by the Long & Alstatter Company. In addition to the tools shown on the plan, the shops are equipped with a portable wheel press, cylinder borer, valve face planer, and other small tools; also with a Hart's flue-welder, and other small tools in the boiler shop. The steam hammer in the blacksmith shop is by the Morgan Engineering Company, being their latest 1,500-pound hammer, and this shop is equipped with post cranes and all regular tools.

"The machinery in the car shop is by Berry & Orton, the fan for the shaving exhaust system, and also for the blacksmith shop being furnished by the Sturtevant Blower Company.

"It is the intention to use these shops for regular heavy repairing for the Western division of this road. As will be seen by the plan, they afford accommodation for six engines, the tools being capable of keeping the work well forward for this number. The engine pits are each supplied with a light over-head traveling crane and the entire buildings will be lighted on the incandescent system by electricity.

"In the car shop heavy repairs and rebuilding as well as running repairs will be made, and the car wheel outfit is placed in the machine shop for both cast iron and steel wheels."

Babbitt Metal.

Nearly every person is familiar with the term, "babbitt metal," but few understand how important the alloy was considered when it was first brought out. At a meeting of the New England Railroad Club, Prof. Waldo said: "In looking up the subject of lubricants we found that a certain man, Mr. Isaac Babbitt, had received a gold medal from the Massachusetts Mechanics' Charitable Association in 1841, and that the ground for the award of that medal, and the subsequent grant from Congress of $20,000, was expressed in the letter from the master mechanic of the Boston & Providence Railroad Company, which was written from Roxbury in September, 1841. In this letter he says that for fourteen months a box of Mr. Babbitt's description has been used continually and has traveled nearly 31,000 miles. He cannot see that the box has received the slightest injury. They require one-half the usual quantity of oil and very little attention, and are at least 75 per cent. cheaper than any he has ever used before.

"If you follow the history of this distinguished inventor, you would know that subsequently he received a grant of $20,000 from Congress in consideration of his having done a great thing for mankind.

"I was told the other day that it was impossible to buy genuine babbitt metal. I went to the Baldwin Locomotive Works, with whom we had some professional relations, and asked them where they got genuine babbitt. They said it could not be bought; it had to be made according to specification. I sent out and bought forty samples of metal marked "Genuine Babbitt." It was bought in every part of the country, from New Orleans to Portland. Of the entire forty there was one single sample, which, by a stretch of courtesy, could be called genuine babbitt; I mean that described by Isaac Babbitt in 1839. I will, therefore, venture the opinion that the mechanical builders of this country are not familiar with genuine babbitt. There are some men who have the skill to make genuine babbitt, and who use it; but they are very few, because the making of good babbitt metal is a very difficult thing, much more difficult than is commonly supposed. But if you put in the boxes under your trains a babbitt metal which does not contain the weakening influence of lead at all, the full amount of block tin of the best quality, only antimony enough to harden it, you get a metal, first, that no amount of hammering will heat, and, second, which the ordinary acids of lubricating oils will not affect; and the truck will run and keep perfectly cool. Mr. Isaac Babbitt himself, in his original patent, used fifty parts of tin, five of antimony, and one of copper. Of course, the very great disadvantage of introducing any lead whatever in a soft bearing is the fact that the metal itself has no compression strain to speak of."

Lewis Valve Gear.

We have received from the Valve Gear Mfg. Co., St. Louis, a blue print giving an isometric projection of the Lewis valve gear, and a circular containing claims of the savings affected by the use of this gear. This gear is a reversible cut-off motion which dispenses with the radial links and eccentrics; it is a duplex movement, deriving its motion from the crossheads, and is so constructed that the lap and lead movement of one side is controlled from the crosshead of that side, while an increased travel to the valve is conveyed from the opposite crosshead, imparting to the valve a quick movement at the most advantageous points during the travel of the piston. The combination of these movements makes the travel of the valve a series of accelerations and retardations, and is identical in both the forward and reverse motions. The principle advantages claimed for the motion are: No links, no eccentrics, constant lead, 5 to 10 per cent. increased power and speed, 15 per cent. economy in fuel and 50 per cent. saving in oil and repairs. An engine equipped with this gear has been running for nineteen months on the Vandalia line.

An improvement in car seats has been patented by Anthony Sekyra, Dayton, O., whereby the seat can be converted into a bed. The invention would be useful on roads where sleeping cars are not run.

Practical Letters from Practical Men.

Facts Wanted. There's a glut of Opinions.

Write on one side of the paper, state your point plainly and briefly, and then quit. We supply the generalities. No letters noticed unless name and address accompany.

High Pressure in Train Pipe on Mountain Grades.

Editors:

The perfect control of freight trains on heavy grades by the air-brake has not been entirely satisfactory to railway people who are responsible for company property.

Messrs. Holmes and Scott must keep up with the procession, and note that the conditions found in passenger and freight service must be met by different methods and practice to insure success.

Let us reason together, to learn how we got into trouble when using the D 8 valve on heavy grades, and also if the pump-governor governs anything during such service, and then for the remedy by the use of the D 5 valve with same train in both cases. With the D 8 valve starting down the grade with 70 pounds train-line pressure, while the application is on, the air pump is working free and fairly fast, and a very high excess pressure, say 120 pounds, is gained in main reservoir.

When train-line pressure shows a reduction to 50 pounds, the handle is moved to full release to recharge. While waiting on 120 pounds pressure to equalize a difference of 70 pounds, you must depend on the retaining valves, and that means piston packing, to hold the train. And during this time, you have no effective brake pressure and the air-pump is stopped.

The trouble was, the next application had to be made before the pressure could equalize, making necessary a reduction of 15 or 25 pounds excess train-line pressure to apply the brake, the same as a 5 pound reduction will when equalized.

That is what is hard on air-pumps, and why so many reports come in that brakes won't hold.

The want of correct information about the feed-groove of the triple-valve is the cause of most all the failures of air-brakes.

When using the D 5 valve, the main reservoir pressure is regulated by air-pump governor and set at 90 or 100 pounds.

At top of grade, place handle in full release and equalize at 90 pounds. Make the same reduction as before, or to 70 pounds (in place of 50 pounds). Move handle to full release to recharge, and note you still have maximum pressure in auxiliary reservoir for brake power for any emergency, and the air-pump is working.

Recharging with 90 pounds pressure in train-pipe, it will require so much less time to equalize that the retaining valves will hold train under control.

In this way speed of train will be regular, and is practicable to follow other trains close and carefully.

Are we of one mind that it is not high pressure in auxiliary reservoirs that slides wheels on cars having 70 per cent. brake power, but always resulting from carelessly making a 15 to 20 pound reduction from the train-pipe at one application. In fact, maximum pressure of 70 pounds is to take care of the automatic application of the brakes.

A good air-brakeman uses the graduating piston in triple-valve and the gauge pointer to do the work required, and knowing something of the proportions of auxiliary reservoirs and brake cylinders, and the F. C. and W. of brake leverage, I would invite criticism to the following suggestions for mountain work:

Never run a train down a grade faster than you can haul the same train up the same grade.

Make the first reduction before maximum speed has been obtained.

Never allow train-pipe pressure to get below 50 pounds. Better to be nearer 70 pounds.

Recharge in full release. It is good practice to recharge as many times as necessary, and about 20 pounds each time. Then but a few times, and perhaps 50 pounds at a time.

Use all retaining-valves.

Never make use of air-brakes and hand-brakes on a train at the same time to regulate speed. J. R. ALEXANDER.

Altoona, Pa.

How Air Gets Out of Brake-Cylinder When Auxiliary Reservoir is Bled.

Editors:

Your second answer to W. H. S., Denison, O., in Vol. 7, No. 2, is all right, so far as it goes. But if there is no air in train-pipe when you bleed an auxiliary reservoir you reduce the pressure from top of slide-valve, when brake-cylinder pressure will force slide-valve from its seat, allowing air to escape to auxiliary reservoir and to atmosphere by way of release cock.

This is proven by your not hearing air from exhaust port of triple when there is no air in train-pipe.

Pittsburgh, Pa. R. B. McLAREN.

[If all the air is out of train-pipe and relief cocks are opened, there is a free passage from the brake-cylinder to the auxiliary, until such time as the check-spring moved the piston and valve back to a lap position; then there would be ten times as much area on top of valve as the port under it; besides, if the slide-valve did lift it would open communication to the exhaust port, and this would be the easiest and nearest way for air from brake-cylinder to escape.]

Derangements of the Triple-Valve.

Editors:

Some of the boys expecting to be examined on the air were talking one day to an engineer who had passed his examination. They were trying to find out some of the most important questions asked, and I heard this engineer say that with a fair understanding of the plain triple-valve anyone could get through his examination all right.

If one had a thorough knowledge of the construction and operation of the triple-valve, and knew nothing else about the brake apparatus, he could not pass any kind of an examination on the air; but the plain triple-valve is the keystone of the system, and anyone who thoroughly understands the triple can be depended on to know enough about the air-brake to enable him to pass a successful examination.

Enginemen have'nt much to do with quick-action triple-valves. They are of the car equipment. The triples on the engine are plain and require but little attention, yet there are few enginemen that may not be tripped up on some points about the plain triple-valve.

A triple valve is the most faithful, requires the least care, and is the most important piece of the air-brake mechanism, and when a plain triple-valve begins to need attention it usually shows it by a continuous blow from the exhaust port, and when this happens the service of the air-brake doctor is required. With the quick-acting triple, blowing is very often caused by the emergency-valve not seating perfectly, but sometimes the gasket between the triple body and cylinder-head is rotted through or torn between the openings to brake-cylinder and auxiliary reservoir, and the auxiliary air will pass through into brake cylinder and escape from the exhaust port.

Plain triple-valves leak at the exhaust port more frequently than do the quick-acting valves, and one cause for this leakage is a loose-fitting or dirty four-way cock—the cock at the triple-valve with handle attached. The air from train-pipe leaks around the four-way cock key and into pipe leading to brake cylinder, but the triple being in release position the air is discharged at the exhaust port.

A leaky four-way cock is bad. If it becomes necessary to cut out the brake and the four-way cock leaks, it often sets the brake, and opening the release cock on auxiliary reservoir will not release it. I have seen this happen several times with the driver brakes cut out, and the shoes would bind and chatter against the wheels because the air leaked around one side of the four-way cock key and into the brake cylinders, while the other side of the key was tight and would not let the air pass back to the auxiliary reservoir and escape.

The slide-valve of the plain triple when in release position should nearly, not quite, touch the upper cap of the valve-case, and the margin is so slight that in some cases the slide-valve strikes the cap, and the area of the triple-piston being so much greater than the face of the slide-valve, the slide-valve is forced up squarely against the upper cap, and one end of the valve will be slightly drawn from its seat and allow air to pass the slide-valve and blow from the exhaust port. This may be remedied in a few minutes by filing the bottom end of the upper cap, Plate D 20.

Sometimes, when there is a blow from the exhaust port, you may take out the triple and find the slide-valve "cocked," the lower end pressed in toward the spindle so far that the graduating valve clamps the small pin that guides it. This holds the end of slide-valve away from its seat, causing the blow. Now loosen the slide-valve and carefully replace the triple. Turn the brake-valve into release position, and if there is no blow at the exhaust port the slide-valve does not strike the upper cap; but now make a sudden application of the brake, say 8 or 10 pounds, and on lapping the valve you can detect a blow which becomes louder after releasing the brake. If you take out and examine the triple-valve you will find that the slide-valve has "cocked" again.

When a quick train-pipe reduction of 8 or 10 pounds is made, the triple-valve pulls down far enough that the air passes over the end of the slide-valve and through the large port in the valve body and into the brake cylinder. This air pressure has great velocity, and when the triple-valve moves up again, the resistance is as though a stick were thrust through the port above the slide-valve; this upsets the slide-valve and causes a blow, but the slide-valve instantly readjusts itself, if in proper condition; but if the graduating valve-pin is slightly bent or too snugly fits the hole in the graduating valve, then the graduating valve will bind on its pin when the slide-valve jumps from its seat and holds the valve "cocked." This small pin is liable to become scratched or ragged, and the edge of the hole through which it passes may get rough and finny; but this is sometimes easy to repair, and I have done a pretty good job of the kind with a pocket knife with a file blade.

WILL W. WOOD.

Terre Haute, Ind.

Who Made the First Blower?

Editors:

In reply to your correspondent E. H. Harman's claim that Mr. P. H. Smith was the first originator of the blower, I beg to state that it was invented in England in 1837, thirteen years earlier than Mr. Wilson Eddy's application of it, that you mentioned last month.

In proof of this I quote from "Dempsey's Locomotive Engine," revised by D. K. Clark, C. E. On page 95 it says: "It was necessary to adapt existing engines, as they were, for burning coal without smoke by simple means and independently of extensive structural alterations. Such adaptation had been attempted by Messrs. Gray & Chanter in 1837, and again in 1839, on the Liverpool & Manchester Railway. They divided the firebox into two compartments—one for coal, the other for coke; they also admitted air in streams through tubes in the walls of the firebox, and they were the first who applied a jet of steam in the chimney (or smokestack) to maintain a draught when the blast was off." REGINALD WRIGHT.

Point St. Charles, Montreal.

That Cab Notice on the T. E. & M. V.

Editors:

In answer to J. W. Wirtz letter in last issue, would explain that the notice referred to is a very old one, having been issued previous to our having air-governors or automatic brakes, and by an oversight has been allowed to remain in the cabs of some of our engines. Our engineers, however, have long since lost sight of this card, and have kept abreast of the times in the handling of air.

S. A. TEAL, M. M.
T. E. & M. V. R R.

Missouri Valley, Ia.

Murphy's Whistle Puzzle.

Editors:

In answer to J. D. Murphy's air brake problem in March number, would say air hose was coupled wrong between engine and tank signal to train-pipe and *vice versa*. In this way a slight leak would start it. Whistle would blow, causing a reduction in train-pipe, which would cause brakes to set, then 20-pound pressure valve would fill pipe and release brake, causing a reduction to make up for refilling auxiliary, which, of course, would cause whistle to blow again, setting brakes, and so on until all the air was gone.

JAS. DOWNING.

Arkansas City, Kan.

The Answer.

Editors:

Found feed-valve in engineer's equalizing discharge-valve turned around, with joint of valve in nut or cap and spring resting on valve seat, allowing direct passage between train-pipe and main reservoir, and angle cock on train-pipe at back of tank slightly open, which caused the blowing of whistle. When opened, drain cock on main reservoir of course reduced pressure, and as train-pipe was in direct communication with main reservoir caused application of brakes; then upon closing, as pump was still working it recharged pipe and caused releasing of brakes. J. D. MURPHY.

Wellington, Kan.

A Whistle Puzzle.

Editors:

Here is a signal-whistle problem for some one to solve. At intervals of about ten minutes the whistle would blow for about five seconds or so. This it would do as long as there was a pressure of 25 pounds or more. The pipes were looked over thoroughly and no leaks found. Pressure-reducing valve was thoroughly examined and found in perfect order; it was a new one. Then the signal valve, which was also new, was taken down, but I could see nothing wrong with it, so I put it up again, and still the whistle would blow as before. Now, I knew there was no leak in any of the pipes, so I concluded the trouble must be in the signal-valve, and took it off again and put on another new one, that cured it. Then I went at the one I had taken off and found the trouble. What was it?

The chart is a great little joker. It is not only a good educator, but it is a "catcher" for those who know all about the angularity of the main rod—in their mind; that little chart has brought out some very funny arguments. Oh! I tell you, I have lots of fun with it.

Syracuse, N. Y. W. F. REEVES.

The Boy Was All Right.

Editors:

You must have had a boy explain the fact ... that you published about a Vauclain compound starting in high-pressure doing all its work with the low-pressure cylinders, pistons of the high-pressure being in equilibrium."

Was it the same boy who gave you the ... about the starting-valve?

Better look sharp, or some other paper will be after you with a sharp stick. Of course, I know it was one of the bulls people, who are not Irish, even, make once in a while.

So few find their way into the LOCOMOTIVE ENGINEERING that we notice those that do.

By the way, what is the compression-valve for in the Vauclain main valve? You explain this yourself without the boy's "help. JACK BOWERS.

Chicago, Ill.

[Jack is a little off his base. In all Vauclain compounds the starting-valve admits live steam into the exhaust of the high-pressure cylinder—no other way to get it to the low. In doing this, live steam reaches both sides of the high-pressure pistons, therefore doing no useful work, the engine being started by live steam in the low-pressure cylinders.

The starting-valve shown in our last ... is the one now used by the Baldwin Locomotive Works. They have used other ..., but they were designed to accomplish the same thing.

The valve in main valve of Vauclain compound is a relief-valve, and is intended to answer the same purpose as relief-valves in steam chests—neither the boy or ourselves know what they have to do with the compression.]

Noisy Pump Governors.

Editors:

In the last issue of your paper I notice a ... criticism by Mr. W. W. Wood of the remedy I prescribed for noisy pump governors, ..., putting a packing ring in the piston.

Mr. Wood says that the steam piston when at rest seats against the cylinder cap above it, and that when in this position the air that gets past the diaphragm-valve leaks around the piston-head, because it is made slightly tapered and the large part projects into the counter-bore. This leakage causes vibration and noise.

I think that this is the correct explanation of the cause of the noise, and agree perfectly with Mr. Wood as far as that goes, but still think that my remedy (the packing ring) is better than the one he proposes (shortening the piston-stem so that the piston-head stands at a lower position when at rest). Even if this stem is shortened the noise will continue unless the piston-head is a pretty snug fit, whereas, if a ring be put in, the fit is made tight enough to prevent vibration in any position. In my previous paper, I neglected to state that on account of the beforementioned counter-bore, or "bevel," it is necessary, in putting in a ring to put it close to the lower edge of the piston head.

When I first began to investigate this troublesome buzz in the governors, it was suggested to me by Mr. Putnam, traveling engineer of the Iowa division of the C. & N. W. Ry., that, for the same reasons stated by Mr. Wood, the noise could possibly be stopped by preventing the piston from raising so far that the head would strike the cap. To accomplish this we had some small brass washers made and put around the piston-rod, just above the steam-valve, these washers being of sufficient thickness to arrest the upward movement of the piston before it reached the limit of its stroke. In one or two cases this was successful for a time, but after a while they began to buzz as badly as before, probably because of wear of the piston head. This plan we tried on quite a number, experimenting with many different thicknesses of washer, until finally we became convinced that the use of a packing ring was more desirable, because more certain.

While on this point my remedy differs somewhat from that recommended by Mr. Wood, I wish to say that friendly criticism, be it favorable or unfavorable, is always welcome, and in addition to this may be very useful. PAUL SYNNESTVEDT.

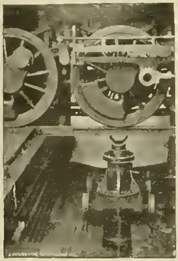
Chicago, Ill.

Some Handy Tools Handled by Air.

Editors:

With this I send you some "snap shots" of air jack and pit for removing engine truck, tender and driving-wheels. They show a pair of 50-inch driving-wheels being removed from a consolidated engine; 6-foot drivers can be handled as easily as 30-inch tender wheels.

This jack has been used successfully for the past two and a half years at the East Buffalo shops of the West Shore Railroad, and entirely does away with jacking up engines.



The pit runs under three tracks, on which engines are placed, and when not in use it is covered over.

In case of a loose driving-box brass or anything of that kind where it is necessary to remove a pair of drivers, it is much less work than raising the engine bodily, as the wheels can be left on the jack low enough to do the work, or they can be placed on the next track if desired until ready to be replaced.

There is a hose connection at each track to connect with jack. It can be operated from the pit or with a three-way cock above pit. The air passes through a check valve just before entering jack; this check has $\frac{1}{16}$-in. hole through valve, letting only enough air escape to lower driving-wheels steadily and safely, and in case of rupture to any pipe or hose from the pressure the wheels cannot drop suddenly. On the lighter wheels this check is not required, as 30 pounds air will handle 33-inch cast wheels; about 100 pounds pressure is required for large driving-wheels.

The cylinder is 11 in. in diameter. On top of the piston is a double screw arrangement for adjustment, when required. There is a 6x9-in. horizontal cylinder in end of pit (not shown in picture) for drawing the truck, on which jack rests, with its load, from one track to the other. The piston in this cylinder is provided with a grab hook at the end, to which is fastened a chain which runs over four pulleys on floor of pit, to jack, drawing it in either direction as required.

It takes less than four hours for four men to do required stripping and remove drivers; a pair of 30-inch wheels is then placed under back pedestal brace, or frame, and engine put in shop. Having used this pit so long, we would hardly know how to get along without it now.

Along with the others, I inclose picture of air-press, 20-inch cylinder, 18-inch stroke, for driving-box brasses, rod-bushes, etc., etc., which "knocks out" screw or hydraulic presses for same kind of work. One hundred pounds air gives about 15 tons pressure on piston; this pressure we can increase to 120 pounds when necessary, and it will press in brasses as fast as they can be placed on the press.

We also have an arrangement for filling sand-boxes on engines, by compressed air, whereby both time and labor is saved. Sand put into the box in this way is clean enough to go through the pipes on engines without the assistance of the coal pick. We placed a boiler, or sand tank, 4 feet in diameter by 12 feet long on end, 6 feet in a box, sunk in the ground; from the bottom of this tank two 3-inch pipes are run up and out over the tracks, high enough to clear the stacks of engines. A sleeve is then dropped into sand-box, and box is filled in thirty seconds.

After sand is dried it is stored in box, being screened at same time directly over sand tank, and is then run into tank through a 3-inch hole, which is then plugged, air turned on, and it is ready for business. The sand does not get damp, as it keeps going out from bottom as fast as used. Fifty pounds of air does the work, and is taken from same large reservoir that supplies the drop pit, etc. An air signal reducing-valve keeps the pressure right, and the sand flows in a solid stream into box without dust.

JOHN R. MACARVEY,
General Foreman.

East Buffalo, N. Y.

[Compressed air is getting to be the common laborer of the modern railroad shop, and in some instances seems to have learned something of the machinist trade as well. The jack here described is practically like the well-known Vreeland transfer jack, except that it is driven by air in place of hydraulic pressure.]

Who Has a Good One?

Editors:

Will some of the readers of your valuable journal please submit a cut of a good gasket cutter for cutting gaskets for throttle-packing. J. J. JONES.

Hanover, Kan.

Economical Little Engines.

Editors:

As it has been stated that the cost of operating street railways by electricity is 2.2 cents per car mile against 5 cents per car mile for direct steam power, I would like to produce a few figures as my experience in that line. For the past few years I have been running a little Baldwin dummy, with 10 x 12-inch cylinders on a short road running out of Brooklyn. The trains consist of one car, week days, and three cars on Sundays. These cars are large eight-wheeled street cars, seating seventy passengers each, or more than twice that of the average trolley car. The day's work is seventy car miles. Fuel, hard coal at $4.00 per ton on the engine.

Cost of fuel per mile, pulling 1 car	$1 42
" oil and waste per mile, pulling 1 car....	20
Total cost per mile, pulling 1 car..	$1 62
Cost per mile, pulling 3 cars—fuel	$2 13
" " " oil, etc.	21
Total	$2 34

Cost per mile, each car, in 3-car train 78 cents.

As each car has a carrying capacity of two "trolley cars," I would like to see it shown where electric cars are cheaper than steam motors. With power-brakes a quicker stop can be made, and in the suburbs much faster time can be made. The only objection I have yet seen to steam in city streets is that in cold weather the exhaust steam is shown and will frighten some horses. E. W. GREGORY.

Brooklyn, N. Y.

Cooling off Hot Pumps.

Editors:

In the March issue of LOCOMOTIVE ENGINEERING, I notice a criticism that Mr. Scott makes of some of my prescriptions. He desires to know, first, why I caution engineers against the use of water internally for hot pumps. In the statement referred to I did not intend to convey the impression that it would do any serious damage to let the water get into the inside of the cylinder in cooling it off, but simply meant to emphasize the fact, that when any such treatment is adopted it must be carefully administered, and to call attention to the fact that if any water gets into the cylinder it will be pumped into the drum. In such a case if it is drained out immediately no damage can result. Many of the most effective air-compressors made are cooled by a spray of water injected into the cylinder at every stoke, this water serving the additional purpose of reducing the dead or clearance space.

To test for leaks in the drum it is of course necessary to stop the pump. Some men might not think to do this if it is not specified, and so I have taken the liberty of inserting Mr. Scott's suggestion into my copy and hereby tender him my acknowledgments for the same.

Chicago, Ill. PAUL SYNNESTVEDT.

We wish again to call attention to the fact that correspondence must be signed by the author's real name and address. Every man ought to be willing to father his own children—we have plenty of our own.

Don't send us any communications with the injunction, "Please don't mention my name," we shall ignore it—and the communication. Letters which writers refuse to endorse with their names are seldom worth publishing.

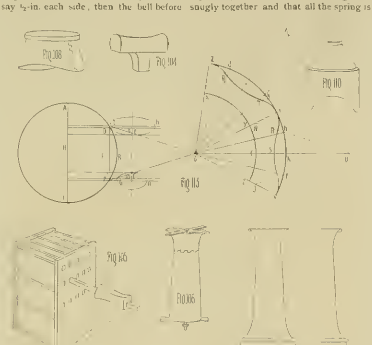
*Railroad Coppersmithing—VIII.

By John Fuller, Sr.

WORKING SHEET BRASS

Among the various kinds of metals and their alloys which have been brought into use and wrought from the sheet into the many forms of ornamental work, to my mind there is none excepting the two precious metals that has or can give to the earnest workman as great delight and satisfaction for the labor bestowed as sheet brass, it matters little what hue or tint may be the most prominent, there is always a pleasant satisfaction after the work is finished, cleaned, and polished. Especially is this the case when the work is finished complete from the hammer. The thought, ever present in the mind of the interested workman, that the result of his efforts is destined to be brought under the close scrutiny of his fellow-workmen as well as that of the general public, is an incentive to greater caution and care on his part that the work shall be carefully and well performed. While there is work executed in railway and marine shops of sheet copper which require much greater skill to perform on the average than is called for ordinarily in working sheet brass, it is almost always from the nature of things carried out of sight and covered up. Most workmen like to work sheet brass after they have become familiar with its properties, and learned by experience the best method of treating it during the operation of shaping to the form desired. I shall now describe some pieces of ornamental brass work for locomotive safety-valve covers and regulator domes, at the same time showing the necessary appliances used in making them, and their application, so that the young mechanic may by using ordinary intelligence, successfully perform that which has been, and is now under some conditions, regarded as a leading or first-class piece of work in the coppersmith's art, and which will serve as a guide to others of a similar nature, although they may be required for an entirely different purpose. The best brass, that is the safest for the beginner, is Bristol brass (see tables, Chap. VII), which, being composed of 8 parts of copper and 3 of zinc, leaves a good margin for the spelter, which is made of equal parts copper and zinc, and will run readily on brass as low as 6 of copper and 3 of zinc with safety. Now, as it seems there are fashions even in the dress of locomotives as before observed, and as I think they are much more attractive when in a dress of ornamental brass work, and as this kind of dress will in all probability be revived again at some future time, the record of my practical experience will be of some value to those who may be called on to perform the work, and I hope save them time and some unpleasant failures. Among these ornaments was a chimney to convey the steam from the safety-valve, while another was a cover for the regulator dome.

These were of many different kinds and shapes, and as those which I shall now consider will answer as a guide to all the rest, I will endeavor to give the details as fully as it is possible, so that they may be easily understood by those interested and seeking such information. Let Fig. 99 represent the cover for a safety-valve, and also to answer the purpose of a chimney to convey the steam escaping from the valve above the head of the engineer. These chimneys were about 2 ft 6 in. in height and some 18 in. in diameter at the base, the foot of which was razed out and made to have an easy flow over the boiler. The chimney proper, as will be seen at *a b c* of Fig. 100 was made in three pieces, which, with the base or foot *d*, made four. Thus the cover at the outset was in four pieces, three of which, *a b c*, were brazed together after being formed into their proper shape, and the fourth, which was the base or foot, slipped into a bead formed on the lower end of the chimney and soft-soldered to its place. I will now give directions for forming it, and for the different stages through which it will pass until finished, together with the tools used. Let it be required that the bell *a*, Fig. 100, at the top measures 12 in., the straight part *b* measures 7 in. at the top and 8 in. at the bottom, and the bell *c* 18 in. at the bottom. First prepare the top, the outer edge of which must be enough larger than 12 in. to cover a ¼-in. wire, say ½-in. each side, then the bell before



wiring would be 13 in. in diameter. The curve or flow of the bell is most pleasing to the eye when it is made an elliptical curve as shown in Fig. 101. All the lines are here given as a guide. Let *a y d b*, Fig. 102, represent the top bell of Fig. 101 before wiring; that is, with the edge flat and measuring 13 in. in diameter, the bottom next the pipe or straight part being 7 in. Draw the line *a b*, of Fig. 102, from the point *a* ½ in. from the outer edge through the points *a* and *b*, and divide the versed sine of the arc or curve into three equal parts. From the point *b* on the line *b d* mark off a distance equal to one-third of the length of the versed sine, and from the point *a* on the line *a y* mark off a distance equal to two-thirds of the length of the versed sine. Draw the line *m c* and continue it to *x*. Draw *x y*. From the points *c* and *d* on the lines *x o* and *x y* lay off the length of the curved line of the bell, then with the radius *x y* thus obtained, describe the arc *g a y h*, and with the radius *x s* describe the arc *r c d s*. Then the surface of the truncated cone *r s* will equal approximately the surface of the bell, of which *g a y h s r* is the pattern. The pattern for the bottom bell is obtained in a similar manner. File up round the outside and inside curved edges, after which thin the two ends and anneal, and scrape or file enough for the seam and cramp one end. Then fold it up as shown in Fig. 103, being careful that the two edges lie snugly together and that all the spring is taken out after the joint is laid and ready for the fire. To assist in this, let the pattern be held fast together with four dogs, two on each side, as shown. Jar a little borax and water through the joint and charge it. Now sling it so that the joint hangs level, and with a clean fire slowly heat it, first on one side and then on the other, until the borax is all down, then with a gentle fire the joint may be easily run down. When cool, the joint should be closely examined to see that all the cramps are well filled. If any are deficient, open the cramp and carefully clean it on the under or inside; then close it down and lay a little fresh spelter on the outside and inside, and run the seam here afresh, keeping the solder from oxydizing by applying powered borax. After the seam has been cleaned off outside and inside it may be rounded up into shape. A hammer should be used as little as possible in dressing the joint. If an oven of a proper heat is at hand and available, the necessary annealing can be better performed in it than in any other way. If there be none, place the work over a clean coke fire and gradually make it a blood-red heat. When cool, take it to a suitable sized mandrel, and with a ball-faced mallet work out from the inside a light course at the small end, then turn it end for end and work out a course at the large end, also from the inside. Now hang it on the mandrel, and work a course in each way toward the center from the outside, being careful the blows are regular, so that all parts receive an equal amount of working strain. If this is not properly attended to there is a likelihood of it cracking when the annealing begins, as brass is very brittle when hot, hence it is necessary that the work should be done regularly and uniformly all round in each course. When, by continued courses, first inside and then outside, the desired size of the two ends and the curve of the bell has been obtained, the edges of the small ends of the bell and pipe may be trimmed true, thinned and annealed and the pieces planished, leaving in each case enough of the outer edge of the bells soft as will be sufficient to cover the wire at the top end, and to form the bead to receive the foot at the bottom. The planishing is best performed on a saddle-head, Fig. 104, if a suitable one is at hand; if not, a mandrel, Fig. 105, may be cast to suit the curve and slide on a square bar fastened in the mandrel block or in a loop in the bench. When the planishing of the two bells and the straight part is completed, and all the edges are thinned, annealed, and scraped or filed clean, cramp the straight part as indicated in Fig. 106, and with a bolt and two pieces of stiff iron draw them together, passing the bolt through them and pulling them together with the screw nut, as shown. Smooth down the cramps with a hammer, and the work is ready for the fire. (When I first began to make these chimneys I encountered many failures, partly from ignorance of the laws of expansion by heat, as also the different degrees of expansion of different metals, but mainly from fear that if the irons and bolt were taken off, the joint would separate while hot; but, one day, by accident, the joints of the two parts not being in line, the bolt was taken out to adjust them, when it was found to be quite a job to pull the joint apart, so after the adjustment was completed an attempt was made to braze the joint without the bolt to hold it together, with complete success. It was gratifying also to see the work was much better than ever it had been done before.) Now take the straight saddle forge, Fig. 107, place it in position handy to a blast slide, or supply a temporary one at the right hand of the forge, and make a clean coke fire in it, jar some wet borax through the joint and charge it slowly all round on the inside, following the zigzag of the cramps, and sling it in an endless chain running over a pulley. Hook this to the chain overhead, holding the end of your work with a suitable pair of light tongs. Now heat it slowly, then tack it by running the spelter in two opposite places, slowly making it hot enough to bring the borax down close, then, with a gentle fire run it round one cramp at a time, always having command of the blast slide, so as to stop immediately if necessary. The lower bell may be brazed on in the same way. When both joints are brazed perfect, and have been cleaned off, and the parts planished and smoothed about them, it is ready for polishing, which is usually done on a lathe. The foot, by reason of its size and straggling shape, is made in two halves to economize the sheet. After the pattern is cut (which will be described further on), the seams made and the foot rounded up, an iron band or hoop, Fig. 100, about 1 in. wide and ¼ in. thick is put on the top or level end, and the brass turned over in some

 These articles commenced in September, 1893.

seven or eight places. This is to keep the foot in proper shape while working out the flow, which is done after the same fashion as the bell, in light courses with a mallet. The valve cover, Fig. 109, has no straight part. After the two bells *e* and *f*, Fig. 110, have been prepared, they are put together at the small ends, the flow at the lower end of the foot *A*, Fig. 111, is next worked out to fit the crown of the firebox, then the upper end of the foot *g* in Fig. 110 or *A* Fig. 111 being razed over enough, as shown, so that the lower bell may be cramped in with ease, the joint is made and taken to the narrow fire, where it may be readily brazed, slung as shown in Fig. 112. After the joint is brazed and cleaned off the planishing is completed on suitable heads, and a ½-in. bead formed around the edge of the foot, which is filled with rough solder. The final polishing is usually done in a lathe.

Directions for cutting the pattern of foot *c* in Fig. 110 will be given further on. We will now turn to Fig. 108 and cut out the pattern for this foot. Let the crown of the firebox *A B C*, Fig. 113, upon which the foot is to stand, have a radius of 2 ft., and the foot of our valve cover *D e f G* have a diameter of 18 in. at the top *e f*, with a flow of 4 in. over the crown on each side, as shown at *e D* and *f G*, and the flow an elliptic curve as indicated by the ellipses on each side. Divide one-half the conjugate axes of the two ellipses which form the curves into four equal parts, and through the points of division *M* and *N* draw the lines *P m* and *O n* parallel to the two transverse axis *G a* and *F b*, cutting the crown *A B C* in *D* and *P*, making the line *D P* 24 inches. Draw *H B O* and produce it toward *K*. Through *P f* and *k e* draw *P f n* and *k e o*, and let them meet in *O*. With the radius *O D* from the point *O*, describe the arc *Z Y X* and make it equal to three times *D P*; now divide the arc *Z Y X* into eight equal parts as shown. On the lines *ZO*, *YO* and *XO* from the points *Z Y X*, lay off the distances *ZI*, *YN*, *XJ* equal to *DF*. Through the points *Ng* and *Nh* draw the lines *NI*, *VC*, and through the points *hd* and *ft* draw the lines *IV*, *JI*, letting them meet in *V* and *C*. Now with *V Y* as radius and from the points *I V J* describe the arcs *Z R I Y R*, and *J X*. Then with *I R* or *Y T* as radius from the points *u* and *v*, describe the arcs *R I* and *R' T'*. From the point *S*, on *O K*, lay off *s r*, the length of the curve or flow *f G*, and with *o r* as radius, from the point *o*, describe the arc *r y z*, then *Z Y X z y x* is the pattern required for the foot, which is represented in Figs. 108 and 113.

Editors:

Let me say a word or two to my readers again. I am a little disappointed that none of the coppersmiths working on railroads have given a hint as to the information that would be of immediate service to them, or that might be of service to them in the future. I should like some for whom these articles are being especially written and intended to benefit, to make their wants known as a guide to the arrangement of the work. Where is Brother Colegrove? Can he inform us how many coppersmiths there are working on railroads in America? I should like to know how many there are in my audience, and to hear them speak out in meeting.

John Feller, Sen.

A railroad man who takes great interest in air-brake matters was prowling about a car repair yard looking for pointers, when he noticed a fresh-looking individual going from car to car marking the triple-valve as having been examined and cleaned. "I don't see that you have had these triple-valves down," remarked the visitor. "Take dot ting down!" said the chalk spreader. "No, I neffer takes him down, cos he fall apart an I gand put him togeder again."

The Elements of Boiler-Making—II.

By C. E. Fourness.*

Geometry.

I will now give a few problems in geometry, enough to show how to draw lines at right angles to each other without a square, two methods of finding the center of a cirle that will cut three points not in a straight line. This is needed by boiler-makers very often.

Two methods of forming an ellipse or oval.

And methods of forming polygons, which are figures formed of straight lines and having more than four sides.

Geometry is the science which investigates and demonstrates the properties of lines on surfaces and solids; hence practical geometry is the method of applying the rules of the science to practical purposes.

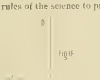


Fig 16

1—From any given point in a straight line to erect a perpendicular, or to draw a line at right angles to a given line.

On each side of the point *A*, from which the line is drawn, take equal distances, as *A B*, *A C*, and from *B* and *C* as centers, with any distance greater than *B A* or *C A*, describe arcs cutting each other at *D*, draw the line through *D* and *A*, and this line will be the perpendicular required.

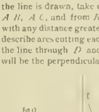


Fig 17

2—Where a perpendicular line is to be drawn at or near the end of a given line.

With any convenient radius, and with any distance from the given line *A B*, describe a portion of a circle, as *A B C*, cutting the given point at *A*, draw through the center of the circle *D* the line *B D C*, and a line from *A* cutting the intersection at *C* is the perpendicular required.

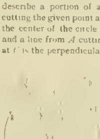


Fig 18

3—To find the center of a circle with the dividers that will cut any three given points not in a straight line.

From the middle point *B* as a center with any radius, as *B C*, *B D*, describe a portion of a circle, *C S D*, and from *R* and *A* as centers, with an equal radius, cut the portion of the circle in *C S* and *D S*, draw lines through where arcs cut each other, and the intersection of the lines at *S* is the center required.

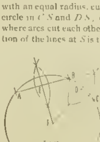


Fig 19

4—Another method to find the center of a circle with a square to cut three points not in a straight line.

Connect the points *A B C* by straight lines, and from the points *D* and *E*, midway between *A B* and *B C*, draw lines at right angles to *A B*, *B C*, and the point of intersection *F* will be the center of the circle required.

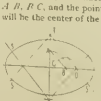


Fig 20

5—To form an ellipse or oval.

On the intersection of the two diameters, as a center with a radius equal to the difference of the semi-diameter, describe the arc *A H*, and from *B* as a center with half the chord *R C A* describe the arc *C D*, from *O* as a center with the distance *O D* cut the diameters in *D R D T*, draw the lines *R S R S*, *T S T S*, then from *R* and *T* describe the arcs *S S S S*, and from *D* and *D* describe the smaller arcs *S S S S*, which completes the ellipse required.


Fig 21

6—My own method of constructing an oval is to draw the arcs forming the ends *F A E* and *H B G*, as I think makes the best proportioned oval to suit my purpose; then I connect the points *E D H* and *F C G*, which forms the oval required.

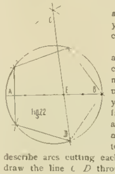


Fig 22

7—To describe any regular polygon in a given circle.

Divide the diameter of the circle into as many equal parts as the polygon has sides, from *A* and *B*, as centers, with a radius equal to the diameter, describe arcs cutting each other at *C*, draw the line *C D* through the second point of division on the diameter *E*, and the line *D B* is one side of the polygon required.

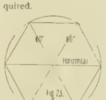


Fig 23

8—The method given in No. 7 can be used to good advantage, but in forming a hexagon the sides equal the length of the radius, so if the circumference of a circle is spaced with the dividers set to the radius, it will divide the circle into six spaces or sides.

Also, lines drawn at an angle of sixty degrees to a horizontal line through the center of the circle divide a circle into six parts or sides.

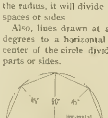


Fig 24

9—To form an octagon, divide the circle into eight parts, as shown by the light lines in Fig. 24, by two diameters at an angle of forty-five degrees, and one at ninety, to a horizontal diameter. Then connect the points where these diameters cut the circumference, and the sides thus formed will complete the octagon required.

I will now start on the laying out of sheet iron work, starting by finding the circumference of a square course, and ending in complex forms. I will begin by giving two tables, one the weight of one square foot of iron and steel of different thicknesses, as it will be needed in approximating the weight of material used. The other table will contain the diameters, circumferences, areas, number of gallons contained in one foot of depth, and the side of a square equal in area to the circle. This latter table takes from 12 to 104 inches, advancing by 2 inches.

There is one matter I wish to mention before going any further, that is regarding the decimals that are used to find the circumference, areas, side of square, etc. These decimals are used by a great many persons who do not know where they are derived from, and should they be asked what the decimals represent and why they are used, a great many would say they did not know, but used them because they were given in the arithmetic to find these required results. The decimal 3.1416 equals the circumference of a circle 1 inch in diameter. The decimal .7854 equals the area of a circle 1 inch in diameter. The decimal .8862 equals the side of a square, equal in area to a circle 1 inch in diameter.

Table No. 1.

WEIGHT OF IRON AND STEEL.

In pounds per square foot.

Thickness in inches.	Iron in pounds.	Steel in pounds.	Thickness in inches.	Iron in pounds.	Steel in pounds.
1/16	2.526	2.75	15/16	37.89	38.50
1/8	5.052	5.35	1	40.42	41.00
3/16	7.578	7.85	1 1/16	42.50	43.50
1/4	10.10	11.00	1 1/8	45.00	46.00
5/16	12.63	13.50	1 3/16	47.50	48.50
3/8	15.16	16.00	1 1/4	50.00	51.00
7/16	17.68	18.50	1 5/16	52.50	53.50
1/2	20.21	21.00	1 3/8	55.00	56.10
9/16	22.73	23.50	1 7/16	57.50	58.65
5/8	25.26	26.00	1 1/2	60.63	61.20
11/16	27.79	28.50	1 5/8	70.73	71.40
3/4	30.31	31.00	1 3/4	75.00	76.50
13/16	32.84	33.50	2	80.83	81.60
7/8	35.37	36.00			

WEIGHT OF SHEET IRON AND STEEL, B. W. G.

No. of gauge.	Iron in pounds.	Steel in pounds.	No. of gauge.	Iron in pounds.	Steel in pounds.
8	6.62	6.71	16	2.61	2.64
10	5.38	5.55	18	1.97	1.99
12	4.37	4.43	20	1.40	1.42
14	3.33	3.37	22	1.12	1.14

Table No. 2.

DIAMETERS, CIRCUMFERENCES, AREAS, CONTENTS IN GALLONS 1 FOOT DEEP AND SIDE OF SQUARE EQUAL IN AREA TO A CIRCLE.

Diameter in inches.	Cir., feet and inches.	Area, square inches.	No. of gals 1 foot deep.	Side of sq. equal in area
12	3.1 11/16	113.09	5.8735	10 5/8
14	3.7 15/16	153.93	7.9944	1 0 3/8
16	4 2 1/4	201.06	10.4413	1 2 1/8
18	4 8 1/2	254.46	13.2150	1 3 15/16
20	5.2 13/16	314.16	16.3148	1 5 3/4
22	5 9 1/16	380.13	19.7414	1 7 1/2
24	6 3 3/8	452.38	23.4940	1 9 1/4
26	6.9 3/4	530.92	27.5720	1 11
28	7.3 15/16	615.75	32.6976	2 0 13/16
30	7 10 5/16	706.86	36.7092	2 2 9/16
32	8 4 1/2	804.24	41.7668	2.4 5/16
34	8.10 13/16	894.61	47.1505	2 5 1/2
36	9.5 1/16	1017.87	52.8618	2 7 7/8
38	9.11 3/8	1134.11	58.8976	2 9 5/8
40	10 5 5/8	1256.64	65.2602	2 11 1/16
42	10.11 15/16	1385.44	73.1504	3 1 3/16
44	11.6 3/16	1520.53	78.9652	3.2 15/16
46	12.0 1/2	1661.90	86.3074	3 4 3/4
48	12.6 3/4	1809.56	93.9754	3 6 1/2
50	13.1 1/16	1963.50	101.9701	3 8 1/4
52	13 7 5/16	2123.72	110.2907	3 10 1/16
54	14 1 5/8	2290.22	118.9386	3.11 13/16
56	14.7 7/8	2463.01	127.9112	4.1 5/8
58	15.2 3/16	2642.08	137.2105	4 3 3/8
60	15 8 7/16	2827.44	146.8384	4 5 1/4
62	16 2 3/4	3019.07	156.7891	4 6 15/16
64	16.9	3216.99	167.0674	4 8 11/16
66	17.3 5/16	3421.20	177.6740	4.10 1/2
68	17.9 5/8	3631.68	188.6045	5.0 1/4
70	18.3 7/8	3848.46	199.8610	5 2
72	18 10 3/16	4071.51	211.4472	5 3 13/16
74	19.4 7/16	4300.85	223.4207	5.5 1/2
76	19.10 3/4	4536.47	135.6607	5 7 5/16
78	20 5	4778.37	248.2270	5.9 1/8
80	20.11 5/16	5026.56	261.1200	5.10 7/8
82	21.5 9/16	5281.02	274.3387	6 0 5/8
84	21.11 7/8	5541.78	287.8032	6 2 7/16
86	22.6 1/8	5808.81	301.7563	6 4 3/16
88	23.0 7/16	6082.13	315.9548	6 5 15/16
90	23 6 13/16	6361.74	330.48	6.7 3/4
92	24 1	6647.61	345.3303	6 9 1/2
94	24.7 1/4	6939.79	360.5085	6.11 5/16
96	25 1 9/16	7238.24	375.9062	7.1 1/16
98	25 7 7/8	7542.97	391.8425	7 2 13/16
100	26.2 1/8	7854.00	408.00	7 4 5/8
102	26.8 1/2	8171.30	424.3625	7 6 3/8
104	27.2 11/16	8494.88	441.2924	7.8 1/8
1/8	3/8			
1/4	3/4			
3/8	1 3/16			
1/2	1 9/16			
5/8	1 15/16			
3/4	2 5/16			
7/8	2 3/4			
1	3 1/4			

*Foreman Boiler-maker, C., M. & St. P. Ry., Dubuque, Iowa.

I hardly think it necessary to explain the use of the table, as that is apparent; but I will explain the use of the figures in the last eight lines (the circumference of the fractions of an inch and of an inch), as they are to be used in connection with the table. For instance, I wish to find the circumference of a circle 15½ inches in diameter, I refer to the table, and find the next size given is 14 inches, the circumference of which is 3 ft. 7⅞ in. I now refer to this part mentioned for the circumference of one-half an inch 1 1/16 in., and of an inch 3 1/8 in. I now add the three together. 3 ft. 7⅞ in. + 1 1/16 in. + 3⅛ in. = 4 ft. 0⅝ in., the circumference required.

NOTE—In making most anything in a circular form, it is necessary to have the course—the required diameter either inside or outside. If the material you are using is very thin, there is no trouble, but when heavier metal is used, it is necessary to allow or deduct a certain amount. If once the thickness of metal be added to the diameter and the circumference found for this new diameter, the course will be that diameter inside, or if once the thickness be deducted, the course will be the required diameter outside. The inside or outside diameter can also be secured by adding or subtracting three times the thickness to or from the circumference as required.

I have a smokestack to build 2 feet in diameter and 40 feet high, to be made of No. 10 iron. There will be one band at the top, another at the bottom, and one guy-band arranged for four guy-rods, also a damper in the bottom course; all these bands and the damper-rod to be made of ½ x 2-inch iron.

I will now find the amount of material needed, and I will use sheets of iron 4 feet wide. I divide the height of stack by the width of one sheet to ascertain the number of courses or lengths needed, 40 ÷ 4 = 10, the number required, but as 1½ inches are taken off each sheet for laps, excepting at the top and bottom, this will make the stack come out 12 inches too short, or 39 feet long, so I will add another course, making eleven in all, and the stack will be 42 feet 11¼ inches in height.

I will now proceed to find the circumference or length of sheet required for one course: 3.1416 × 24 in. = 75⅜ in., but this length would only give me 24 inches from inside to outside, and as I want the diameter inside, I will add three times the thickness or three-eighths. As No. 10 iron is one-eighth of an inch thick, this gives me 75¾ inches, the circumference required to let the sheet butt, or length from center to the center of the rivet-holes. I now add 1 inch for laps, this gives me 76¾ inches full length, this divided by 12 equals six and thirty-nine one hundredths, the circumference in feet; this multiplied by 11 gives me seventy and twenty-nine one hundredths, the number of feet of iron, 4 feet wide, required to make the stack. This length again divided by the length of one sheet (in this case 10 feet) gives seven and two one hundredths sheets required.

I will now find the weight of sheet iron in the stack by multiplying the total length in feet, seventy and twenty-nine one hundredths by four feet, the width of the sheets, this equals two hundred and eighty-one and sixteen one hundredths square feet, and by referring to Table No. 1, I find one square foot of No. 10 iron weighs five and thirty-eight one hundredths (5.38) pounds. Then, two hundred and eighty-one and sixteen one hundredths (281.16) multiplied by five and thirty-eighth one hundredths (5.38) equals one thousand two hundred and eighty-three and forty-five one hundredths (1283.45) pounds, call it 1,284 pounds. The damper, 23½ inches in diameter, will weigh 16 pounds, 1,284+16=1,300 pounds.

I will now proceed to find the weight of iron in the bands and damper rod. As the large course is 24¼ inches in diameter inside it will be twice the thickness or 24½ inches outside, this multiplied by 3.1416 equals 76⅝ inches. These bands are ½ inch thick, consequently in adding three times the thickness I will add 1½ inches to let the ends butt. This gives a length of 77⅞ inches (I will not allow anything for scarfing and welding) for top and bottom bands. For the guy-band, this will be made in halves and fastened together by two ⅝-inch bolts, these halves are left 1 inch apart on each side to allow the band to be drawn up tight, and also two guy-rods are attached to the bolts in these spaces. I now take the same circumference used for the other bands, 77⅝ inches, deduct 2 inches to allow the 1 inch opening on each side, then add 2 to each of the four ends or 8 inches, these are to be flanged to form the clamps to hold the band together. I will require 6 inches more material of which to make the additional two eyes to rivet in for attaching the other two guy-rods. This makes a bar 89⅝ inches long. Then the amount of bar iron needed will be

For top and bottom bands	155¼ in.
" guy-bands	89⅝ "
" damper-rod	27 "
	271⅞ in.

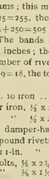
This divided by 12 equals 22 ft. 7⅞ in., this multiplied by 3.32, the weight per foot of bar iron, ½ × 2 in., 22.656×3.32=75.21 pounds—call it 76 pounds.

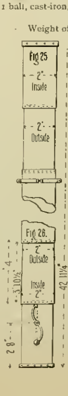
I now want the number of rivets needed. The circumference, 75¾ in., divided by 3 in., the pitch or distance apart, equals 25.12 (I will say 25, and space slightly over 3 in.) I will have ten of these circular seams, consequently I will need 25 × 10, or 250 rivets for these seams.

Now for the straight seams. The distance between the circular seams is 46½ in., and this divided by 3 in. equals 15½, I will call it 15 and space the rivets a little further apart. As each sheet will make one full course and part of another, I will have 5 with 1, and 6 courses with 2 seams; this makes a total of 17 seams. 17 ×25=255, the number of rivets required, 255+250=505 rivets, total number.

The bands divide the circumference by 8⅜ inches; the pitch, 75.375÷8.39=9, the number of rivets needed for one band, and 2×9=18, the total number of rivets needed.

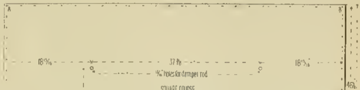
MATERIAL.	POUNDS.
No. 10 iron	1,300
Bar iron, ½ x 2 in.	76
" " ½ x 24 in. (½ in. round for damper-handle	1.5
12-pound rivets	6.25
⅜ x 1-in. "	1.
2 bolts, ⅝ x 2¾ in., for guy-band; 3 " ⅜ x 1½ in., for damper	1.
1 ball, cast-iron, 3 in. in diameter	3.75
Weight of stack	1,389.50

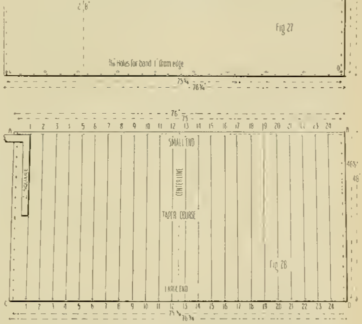




I will now start to lay out a pattern. The stack can be made two different ways—one of square courses, one course entirely inside and the other entirely outside (see Fig. 25), or of taper courses (see Fig. 26) (I made the upper part of square and the lower of taper courses to show the difference.) I will now lay out the large square course, Fig. 27. This course must be 24 inches inside, and I found previously that the circumference for that diameter is 75¾ inches. I now draw the lines *A B* and *C D* 46½ inches apart, parallel to each other, and an equal distance from the sides of the sheet. I then draw the line *A C* one-half inch from the end of the sheet and at right angles to the lines *A B* and *C D*. I now draw *B D* parallel to and 75¾ inches from *A B*. This completes the outline. I will now proceed to space off with my dividers 25 points on each of the lines *A B* and *C D* for rivet-holes. Bear in mind in getting these points one corner hole should only be counted, as the corners lap and form one hole. Next I take the longitudinal (straight) seam *A C* and *B D*, space this into 15 points or holes, exclusive of the corner (lap) holes. This completes the large course. Allow one-half inch for lap outside of *B D*. Now for the small course. This will be 24 inches in diameter outside, 3.1416×24= 75⅜, I now deduct ⅜ inch, leaving 75 inches, the circumference of the small course. I now proceed in the same manner to lay out the small course as I did the large, the only difference using the shorter circumference of 75 inches, instead of 75¾ inches.

The Taper Course, Fig. 28—Draw the line *A B* one-half inch from the edge you make the small end of the course, and *C D* 46½ inches apart and parallel to *A B*. Locate the lap hole at *C* one-half inch from end of the sheet on the line *C D*, *D* will then be located the length of the circumference of the large end 75¾ inches from *C*. I now find the center point between *C* and *D* as *E*, and at this point *E* erect a center line, *E F*, at right angles to *C D*. I then locate points or lap-holes *A* and *B*, the circumference of the small end, or 75 inches apart, and one-half this distance, 37½ inches, each side of the center, *F*, then connect the lap-holes *A C* and *B D*. These lines form the straight seams, and must be spaced off for fifteen rivets. I then space off the holes on the large and small ends of the course on the lines *A B* and *C D* for twenty-five holes. I then draw lines connecting the opposite holes, as 1.1', 2.2', 3.3', etc. I then lay a square along and to the line 1.1 and the blade of the square at the point *A*. I draw a short line across the line 1.1', at this point the rivet-hole is to be punched. Next move the square to line 2.2', bring the square up to the line and the blade to the short line across 1.1', then draw a line across 2.2; this is the center of that rivet-hole. Then move to lines 3.3', 4.4, etc., till line 12.12 is reached, the middle. Then start at the other end and lay the square along the line 24.24, the blade at point *D*, and proceed to line 13.13, as I did at 1.1, 2.2', etc. This places the holes in the small end, so when the sheet is rolled up they will be on a line parallel to the base. To locate the holes in the other or large end, I take the trammels and set them to the length *A C*, or 46½ inches, then set one point at the intersection of the short cross line with 1.1, 2.2, etc. (the center of the holes in the small end). I make a mark across the line 1.1 at 1', 2.2, at 2', etc. This mark I make on all the lines. These are the centers of the holes in the large end.





To lay out the holes for the bands it is not generally practiced, but can be accomplished very readily, as the bands are 2 inches wide and the holes will be placed in the center of the width. This will bring the holes 1 inch from the edge of the sheet. I now draw a line 1 inch from the bottom edge of Fig. 27 (if I were to lay them off on the taper course, Fig. 28, I would have to follow the curve formed with the holes), and space it off for nine rivets as shown in Fig. 27.

To lay out the holes for the damper-rod, I first draw a line 2 ft. 8 in. from the bottom, and then dividing the sheet into one-quarter by spacing or dividing the circumference by 4 as 74¾ + 4 = 18 11/16 inches, the distance from the straight seams and the holes will be twice this distance or 37¾ inches apart.

A new illustrated catalogue has been published by the Taylor Electric Truck Co., Troy, N. Y. It shows by means of excellent wood cuts the designs and details of the various trucks made by this company for street railroad service. The catalogue is supplied free to those applying for it.

A form of metallic valve stem packing has been patented by John Olson, Two Harbors, Minn., which has rather novel features. It is described as a combination of two or more spaced packing rings with peripheral seat-channels and oblique steam-admission passages extending from the periphery to the back of the packing rings. These channels are in communication with an annular steam space which is between the valve stem and the packing gland. By means of the arrangement the first packing ring can be expanded by steam from the steam chest to take up the wear and prevent leakage.

?A. What You Want to Know. ?A.

Don't ask questions that simply require a little figuring to determine, make each question separate. No notice taken of anonymous questions.

(57) P. Wells, Owosso, Mich., asks:

What is the difference between a consolidated, a mogul and a decapod engine? *A.*—A consolidation has eight drivers connected and a two-wheeled truck, mogul, six wheels connected and two-wheeled truck, decapod, ten wheels connected and two-wheeled truck.

(58) T. E. J., Albany, Ga., asks:

Will you please tell me what is meant by clearance of valve? *A.*—You probably mean inside clearance. This means that the exhaust cavity of the valve is wider than the exhaust port and both bridges by the amount named. Very few locomotives have inside clearance.

(59) A. B. C., St. Louis, Mo., asks:

1. What could happen that would cause you to disconnect without covering the ports? *A.*—It would be of no use to cover ports if steam chest was broken—say the cover off. 2. What is preadmission. *A.*—Admitting steam to cylinder before piston has completed its stroke.

(60) E. S. Westbury, L. I., asks:

How long does a person have to serve as an apprentice to learn the machinist trade in the repair shops, and how much does he get at the beginning? *A.*—All depends where you are, how the business is, and how you work. Generally three to four years to learn the trade. Laborers' pay is big for apprentices.

(61) Apprentice, Toronto, Can., writes:

Please tell us how to set valves. I see some months ago you referred those who asked this question to your issue of January, 1893, but this is now out of print. *A.*—We cannot very well repeat such a long article so soon. The writer should have Sinclair's work on locomotive running and management, which tells how to set valves.

(62) W. W. H., South Bay, Me., asks:

How many locomotives can Baldwin's turn out in thirty days, and how long does it take them to make a locomotive boiler? *A.*—About ninety engines per month. Time required to build a boiler depends on what is ready in the shape of material. If an odd boiler was asked for, it might take two or three weeks, if material was on hand one might be completed, from start to finish, in five or six days.

(63) A. M. S., Fort Madison, Ia., writes:

In books on the locomotive we are always told to take down both side rods in case of one breaking. I don't see why this should always be done. One rod will keep the cranks of both wheels in the same relative position. *A.*—It is never safe to run with one side rod. If the engine slips when the crank the side rod is on is on the center, the back crank is likely to be forced in the wrong direction, and in that event something must break.

(64) F. E. A., Little Rock, Ark., asks:

Does the cross-head move *back* when a locomotive is going ahead? *A.*—In its relation to the engine, yes (or rather it stands still and the engine runs past it), in relation to ground, no, for the wheels are carrying cross-head, guide and all, ahead all the time. When an engine is going out of the house place a stick or other marker on the ground and even with the cross-head when on forward center, and note what happens when engine moves.

(65) W. A. W., Cheyenne, Wyo., asks:

Will you please give me some good prescription for dope to scour brass. *A.*—A good "dope" is made as follows: 6 sperm candles, 1 pint signal oil, 1 oz. gum camphor (pulverized), ½ oz. arsenic, half a bath brick (powdered), ½ pint ammonia. Melt the candles in the dish you wish to keep your dope in (a small lard pail with cover is handiest), then stir in the other ingredients, the bath brick last. This makes a first-class polish for brass, especially if warm.

(66) Inquirer, Indianapolis, Ind., writes:

We have some passenger engines with cylinders 18 x 24 inches, drivers 66 inches diameter, and carrying 160 pounds steam pressure. A dispute has arisen about the horse-power of the engines, and several of us would like to know what would be the horse-power when running at fifty miles an hour and the steam at the blowing-off point? *A.*—That could not be answered without an indicator diagram to show the pressure in the cylinders. Figuring without that is mere guessing.

(67) V. F. V., Lowell, Neb., asks:

Can you tell me about the locomotive "Duplex." I think it was got up something like seven or eight years ago. How did she differ from others of that date? She was talked about a good deal when first put out, but never hear of her any more? *A.* The "Duplex" was a Strong engine built by the Lehigh Valley Road. She had twin fireboxes of corrugated tubes without stays, and a peculiar valve-motion and steam-chest arrangement. Several of the class were built, but all were failures.

(68) A Reader, Montreal, Can., writes:

1. In what position should an engine be placed for keying up the big and little ends? (front and back ends of main rod.) *A.*—On the eighth—that is between center and quarter. 2. What position should the engine be in for keying up side-rods? *A.*—On center. When the work is done in the shop and a tram employed, the machinist often prefers to adjust the rods on the eighth. 3. Is there any book that gives information about the keying and care of rods? *A.*—Sinclair's "Locomotive Engine Running" gives a chapter on that subject.

(69) J. S., Bradford Pa., writes:

At a popular resort here, several questions arose about the difference between steam pressure in boiler and in the cylinders, and it was decided to refer the dispute for the decision of LOCOMOTIVE ENGINEERING. 1. Suppose an engine was working slowly on a grade and having 180 pounds pressure on boiler, would a gauge placed on cylinder indicate the same pressure as the boiler pressure gauge? *A.*—No, it would vary from 5 to 20 per cent. lower according to the size of the steam passages. 2. If an engine was standing still, and the throttle wide open, would there be a difference between the boiler gauge and a gauge placed on the steam-chest? *A.*—No.

(70) N. L. M., St. Louis, Mo., asks:

1. Do you think that cast steel would be good for back head of locomotive type of boiler for model locomotive, scale, 1½ in. to 1 ft., thickness of heads, $\frac{3}{16}$ in. *A.*—Might do, sheet steel would be better. 2. Why is it that one out of every four exhausts of a locomotive is different from the others? *A.*—Difference in volume of steam release or some other detail. 3. How is aluminum hardened or tempered? *A.*—We don't know that it has ever been done. 4. Will a copper patch work itself loose from a steel firebox from difference in expansion of metals? *A.*—Not if properly put on. 5. Do you think that injectors on a scale of 1½ in. to 1 ft. will work—style, Monitor No. 8? *A.*—Yes. 6. What is the shrinkage of cast steel per foot? *A.*—About one-quarter of an inch per foot.

(71) C. A. R., Cedar Rapids, Ia., writes:

Will you tell me what basic steel is, and in what way it differs from other steel? Is it better than common steel? *A.*—Good steel is usually made from iron which has been purified from the acids, phosphorus and sulphur, the great enemies of good iron, by puddling, or it is made from ores that contain very little impurities. This makes the steel rather expensive. The basic process was invented to eliminate the phosphorus and sulphur while the metal is passing through the furnace, so that steel could be made from inferior ores. The process is to line the furnace or converter with a basic material for which the acids have a strong affinity. They leave the iron and combine with the basic lining. Steel produced in this way can be made almost free from phosphorus and sulphur, but the product is said to lack uniformity and it is generally considered inferior to steel made in the ordinary way.

(72) L. H. L., Port Jervis, N. Y., asks:

1. Would like to know why coupling-rods are more liable to breakage than main rods? *A.*—At high speeds the coupling-rod has to stand an immense strain when it stops at the bottom of its downward throw and starts up, it must be stiff in the direction of its depth to resist this strain. One end of the main rod has no vertical throw, moving horizontally alone, and is therefore subject to less of the vertical strains. The probable reason for breakage of most side rods is the fact that they are coupled rigidly at each end, and the movement of the wheels in the jaws of the frame changes the distance between the centers. Most side rods are kept up too snug. The front end of the main rod can come and go, only one end is rigidly fixed—the back one. 2. Is a "fluted" or I section rod stronger than a plain rod? *A.*—Of the same weight, yes. 3. Is there a current of steam in the oil pipes which convey oil to steam chests from lubricator? *A.*—It is very slight, the hole in upper nipple being only about $\frac{1}{16}$ of an inch in diameter.

(73) W. H., Winnipeg, Man., writes:

We have here an engine built at Kingston, Ont., that has her suspension stud *above* the center of the link. I looked up Sinclair, and he says it is to insure a better distribution of steam, but says it is not found practical for locomotives. Now, as this engine is a first-class one, I want to know why this arrangement has not been found practicable. *A.*—Suspending the link from a point above the center was first practiced by Wm. Mason, his object being to prevent as much as possible the slip of the block. He designed his link motion so that when the engine was cutting off at about eight inches of the stroke the link block would be opposite the suspension stud and the top of the hanger opposite the center of the rock shaft. As they both swing through, practically the same arc, there was no slip of the block except that due to the angle the link assumed. This slight movement was found to wear the link more than where the slip was greater, and, besides it distorted somewhat the back-up motion. It is one of those little things that might be changed either way without noticing it.

(74) W. D., Blue Island, Ill., writes:

Referring to question No. 34 on your examination chart, "What is inside clearance?" I am in doubt as to the correct answer. I say that "lap" may be termed "inside clearance," and "lead" "outside clearance," on account of their clearing the feed and exhaust ports accordingly. I have asked a dozen engineers here this question, and they all answered, "The distance between the piston and cylinder-head," except one, and he said, "The cavity in valve." I being an apprentice, and not wishing to dispute their word, I ask for advice. *A.*—Inside clearance is the amount of opening between the inside edge of the valve cavity and the valve-seat bridge when the valve is upon the middle of the seat. Very few locomotives have inside clearance. They generally have a little inside lap which is measured by the distance the inside edge of the valve extends over the bridge when the valve is on the middle of the seat. When a valve has neither inside clearance or inside lap, it is said to be made line and line. The distance between the piston and the cylinder head is called "piston clearance."

(75) N. A. S., Two Harbors, Minn., writes:

1. On a locomotive, long arm of tumbling-shaft stands at right angle to the other two, and valve gear is adjusted correctly. Now, if I replace the long arm with a new one, and place it so on the shaft that center of top hole is two inches back of right angle with the other two arms, and I shorten reach-rod two inches, will that change affect the valve-gear and the working of the engine in any way? A claims it does and B that it does not. Who is right? *A.*—Probably in practice this change would make very little difference, but it makes some, the difference increasing as the arm is shorter. The farther back the arm is carried, the *more* the reach-rod would have to be advanced to move the links a given amount. Take an extreme case, and suppose the arm set almost at the horizontal, advancing the reach-rod two inches would move the tumbling-shaft ahead some, but the angle the reach-rod formed would shorten the distance between the lever and the tumbling-shaft arm. Beside this, the farther back the arm was inclined the harder the engine is to handle. 2. Why are some locomotive tumbling-shafts made so that the long arm sets back over right angle from the other two? *A.*—Probably for convenience in most cases. Some are so arranged as to move the link in the forward motions while the arm is passing the horizontal position.

The Lake Shore & Michigan Southern people have specified cast-steel centers for the driving-wheels of the locomotives they are getting built at Brooks'. President Newall is said to entertain very decided views about the necessity for reducing the weight of the parts that impart blows direct to the rails without the intervention of springs. The extremely heavy driving-wheels used on some roads must be very destructive to rails and rail joints. This subject has not received the attention it deserves, which is due, in a great measure, to the want of co-operation between the mechanical and the engineering departments of our railroads. If the men most interested in the track had more to say about the parts of rolling stock which affect the rails and bridges, there would be fewer heavy driving-wheels and fewer heavy trucks with all the weight beneath the springs.

Where there is very heavy traffic in switching yards and similar places it will be noticed that the heads of some of the rails are squeezed out in a way that makes an observer conclude that sufficient pressure has been put upon the metal to make it flow as if it had been melted. This phenomenon made scientists believe that if sufficient pressure were applied every substance could be made to melt and flow like water. The Geological Department of the U. S. Government lately made some interesting experiments to determine what there was in the theory of the flow of solids. With an apparatus constructed by the American Tool & Machine Co., of Boston, and the Emery testing machine at Watertown arsenal, they applied a pressure to various substances of 6,000 atmospheres, or 88,200 pounds to the square inch. Among the substances subjected to this pressure were antimony, beeswax, paraffin, bismuth, lead, and silver. No indications were found of any of these substances inclining to liquify at the pressure named.

On no system of road in this country is the general average of engine supplies better than on the E. T. V. & G. Superintendent of Motive Power W. H. Thomas and his master mechanics have somehow interested the engineers until there are few who do not have a pride in the appearance, performance and oil and coal record of their engines.

Wouldn't Carry Passengers' Baggage.

"I noticed," remarked the returned tourist, "that on the Rio Grande Western they have colored porters in the day coaches for attending to the comfort of passengers. A very good practice that is, and one which ought to be introduced everywhere."

"Do you know how that practice of having colored porters in ordinary trains was first started?" asked the car tracer.

Nobody knew just how the thing originated, but all thought the idea a good one.

"I can tell you all about it," resumed the car tracer. "I was out in Denver hunting for some lost cars when the thing happened. There was an English lord or a nabob of some kind traveling out that way, and he came to the train with two heavy bags. When he got to the train he asked the brakeman to take his bags into the car.

"'Go to blazes!' said the brakeman. 'Do you take me for a blanked blank nigger?'

"The nabob was wroth at this treatment, and made a strong kick, with the outcome that the brakeman was suspended. The super. intimated that the brakeman would learn better manners before he went out on a Rio Grande Western train again. But it was easier to threaten than to punish a brakeman in those days. The Brotherhood took up the case, and were ready for a fight to settle the question, 'Is it a brakeman's duty to be a lackey to all the passengers?' There were for a time prospects of a hot time, but a strike was averted by the company restoring the brakeman to duty without loss of pay, and the putting of colored porters on the trains to attend to the needs of passengers."

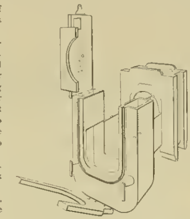
"I happen to know of a similar case on the Denver & Rio Grande," remarked Sam Short, "but it did not end exactly in the same way. A mountain ranger who had two heavy bags and other traps arrived at a station close on train time, and called on a brakeman to help him to get the things into the car.

"'You be blanked, carry your baggage yourself' answered the brakeman, 'I'll be a burro for no man, you son of a sea cook.'

"'You won't, won't you,' said the mountain man very quietly, taking out his six-shooter, 'take up those things and carry them into the car, or I will shoot the stuffing out of you.' The brakeman obeyed very meekly, and there was no call for the Brotherhood to interfere in the settlement of that case."

A New Truck-Box Oiler.

On this page will be found a cut of a new truck-box oiler devised by Mr John M Smith, of Monroe, N. C., and in use on the G., C. & N. division of the Seaboard Air Line. As can be seen the device is fastened to the inside end of oil cellar, and is pulled out with it. The hinged piece



closes up tight to axle and prevents the escape of oil, and when down allows cellar to be withdrawn where considerable collar has been worn on axle

It is practically dust and cinder-proof, admits of packing cellar without taking it out, and furnishes sure means of oiling cellar packing on the road. The device is well spoken of by engineers who have run engines with it on.

Short of Material.

Mr. Thos. B. Purves, Jr., is not only a first-class master mechanic, but he obtained while in East Albany the reputation of being an excellent Sunday-school superintendent. Unlike many men who engage in this line of educational work, Mr Purves is of a genial, fun-loving temperament, and he is even not beyond the practice of joking about incidents of his Sunday-school experience.

At a recent meeting of the Flat Wheel Club, some of the members were relating anecdotes of children, and it was not long before Mr. Purves thought of one.

"One time," he remarked, "I was putting my class through a course of Bible history, and the children were questioned not only about events in the reading, but they were asked for their opinion of the why and the wherefore of things done. The lesson was in Exodus, and was the chapter where it is related that the Israelites gave up their earnings to make a golden calf.

"One question naturally was, 'Why did these people make a golden calf?'

"No answer came for a time, boys and girls being equally bewildered, till one bright little girl looked up with a look of triumph and piped 'Please, sir, it was because there were not earnings enough to make a cow.'"

Cleveland Twist Drill Co.'s Counter Bore.

The counter bore or facing bar illustrated is a new tool, gotten up by Cleveland Twist Drill Co., Cleveland, O., and was first shown to the public at their booth at the World's Fair, where it was very favorably commented upon by some of the best known mechanics of the country, and they

report many sales already. The blade or cutter is held centrally in the taper plug by a conically pointed set screw, shown in the illustration. This plug or holder, as it is called, is fitted into the ordinary twist drill socket of any convenient size, the end of the socket having a slot or notch milled across its open end to receive the top of blade or cutter. By this arrangement the whole strain comes on the larger socket or driver, and there is no twisting or other strain whatever on the smaller part. The end of the holder is turned down as small as is consistent with the necessary strength, and hardened steel bushings of various sizes are furnished with each tool to act as leaders or pilots. Blades of the correct angle for countersinking for screw-driver headed machine screws can be furnished extra. These tools are no experiment, as they are already in use in some of the foremost shops in the country, from the smallest size up to blades 6 inches long. This tool is called by the manufacturers a common sense counter bore or facing bar. The several parts are made to standard jigs, and are carried in stock, so that any piece can be duplicated with the certainty that it will fit into its place properly. Prices of the combined tool or any of its parts furnished on application to the manufacturers.

Easy Enough if You Only Know How.

The old timer from the M. K. & T looked around the circle with a "oh, you are so young" look, and said: "The kids they're raisin' nowadays ain't no good 'ceptin' so long as the mill is all right, why how would enny of you fellers git in with a passenger train with the front bridge broke out, of the left side, lessin you wos towed or went on one side?" All looked wise, but one kid asked how in thunder any one could get in that way and asked, "Have you done it?" "Done it! Why, yasser; it's easy enough when you know how. That same happened to the old 'Cherokee' one time when I was runnin' her, and I done same as any fore-sitted man would do, run her 'round the Y and *backed* her in, of course!"

He Knew Their Habits.

A friend on the L. & N. gives us a little tip on human nature as follows

Recently, on one of the roads in this vicinity, an engineer pulled away from a station in such a lively manner that the "man who carries the bills" got left. This incident caused instructions to be issued that engineers must not disregard rule requiring the engineers to blow for signal from conductor and answer it when leaving a station. A new conductor was examined on time card. He was asked "What is necessary before a train can leave a station?" "A signal from the conductor," he replied. "And then what does the engineer do?" "Gets down and oils around."

An English writer describes a fast engine being built at Wolverhampton as having 12-foot wheels and a *thirty-minute* stroke. This is only equaled by the American engineer who described a bogy engine as having "a three months' lap"

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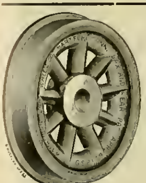

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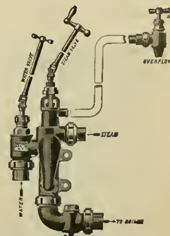

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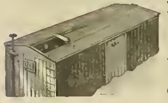

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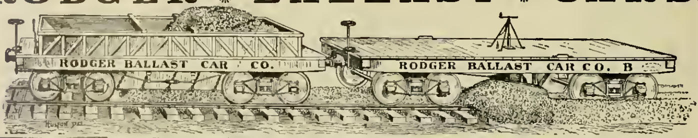
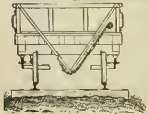
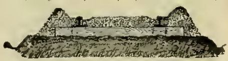




These cars are 34 feet long, and are built either 50,000 or 60,000 lb capacity, M. C. B Standard. They carry from 18 to 20 cubic yards of gravel or broken stone. In using them no ballast is thrown in the ditch, and none is wasted, as the precise amount of ballast needed can always be discharged. A train of 25 cars, carrying 500 yards of ballast can be unloaded and the ballast distributed, leaving the track perfectly cleared and flanged, as shown in the cuts, in from 12 to 15 minutes. This is all done by the regular "train service" (a conductor and two brakemen), no extra help being required. The track is perfectly cleaned by the spreader, so that a train can immediately pass over it at any rate of speed, without meeting any obstruction. No aprons are needed; no wire cables are used. There is no shovelling ballast from between the cars, and no cleaning the tracks with shovels. The ballast is left between the ties and on their ends, directly in position for tamping, when the track is raised, without being shoveled in from the ditch. The average saving per mile, in the amount of ballast needed to make a "raise" of 10 or 12 inches, will be about 400 yards and often far exceeds this. The total saving per mile in material, labor, time, use of cars, saving in transportation, etc., is found to amount, in gravel, to from $250 to $400, and in broken stone it often amounts to $500.

These cars are in use on the Great Northern Ry., the Illinois Central, the Gulf, Colorado & Santa Fé, the Chicago & Eastern Illinois, the Penn. Lines West, and other roads.

Detailed information will be furnished by circular by addressing the



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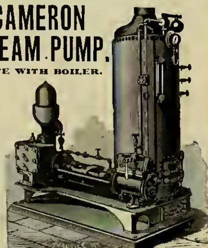

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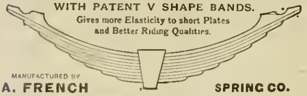

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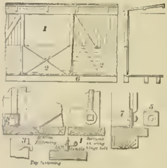

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Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock.

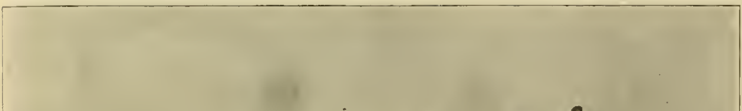
VOL. VII. No. 5. NEW YORK, MAY, 1894. 20 Cts. Monthly. $2.00 Per Year.

Extending the Use of Compressed Air.

In nearly every railroad shop in the country the men in charge are introducing methods of transmitting power by compressed air or extending the equipment already in use. No more convenient means of doing work in out-of-the-way places has ever been introduced. Every day new uses are discovered for this clean and reliable medium. Steam and electricity have both been thoroughly tried, and both have their advocates, but both these mediums are given to shortcomings of which compressed air is entirely free. A very good paper on the advantages of using compressed air for shop and yard purposes was lately read at the Central Railroad Club by Mr. J. H. Chubb, of the Michigan Central. After dwelling on the importance of having air in yards for the inspection of cars, he said

"The distance to which air can be conveyed through pipes is almost unlimited. The Pennsylvania Railroad Company has carried air six miles to their interlocking system at Wilkinsburg, near Pittsburgh, and in Chicago, at the present time, arrangements are being made to lay pipes of large dimensions extending several miles to different parts of the city, to carry and distribute compressed air for power purposes in manufacturing, the only requirements being that the compressors be located at the power point, and air reservoirs to discharge into and to be drawn from, be placed at the points where it is to be used. By taking advantage of this system of long-distance piping, one of the greatest obstacles in organizing an air-brake plant, that of expense of operating, can be considerably reduced, but there are places where this cannot be done, and the establishing of a steam boiler, with an attendant, in addition to other parts of the plant, will be necessary."

In connection with the application of compressed air for the operation of tools or the transmission of power, there is one thing that it would be well for men in charge of shops to remember. They have no right to apply air to tools that are patented to work by water or steam. If they do so they must expect to pay royalty on the patents.



Giant and Dwarf—Standard Passenger Engine of the Delaware, Schuylkill & Susquehanna, with Cooke No. 4 Alongside.

Prospects of Raising Funds to Test Locomotives.

This year has not been a good season for collecting money from railroad companies to defray the expense of locomotive tests. When the Railway Master Mechanics' Convention met last June there appeared to be no cloud in the business and financial atmosphere, and when the request was made by the committee in charge of locomotive tests for the Executive Committee to raise $5,000 to defray the expenses of laboratory tests at Purdue University there seemed to be no doubt whatever that the sum called for could easily be secured. The members had, however, scarcely all returned to their homes when the worst financial disturbance this continent has ever seen burst out like a thunder storm from a clear sky. Railroads were among the first business interests to feel the shock, and company after company went into the hands of receivers, while those that remained solvent entered upon a course of retrenchment and rigid economy that denied the expenditure of a dollar that was not absolutely necessary. This condition of affairs had become general when the secretary of the Master Mechanics' Association, representing the Executive Committee, began asking for contributions to pay for the locomotive tests. Many of the railroad presidents were interviewed and all others likely to contribute were appealed to by letter. All were sympathetic and commended the work proposed, but the general disposition about contributing money was well expressed by one railroad president who wrote "Wait till the clouds roll by." A few were willing to give the contribution asked for, but they were so few that the entire sum of money available was not sufficient to begin work with.

When the case seemed hopeless for this year, the Western Railroad Club took it up, and Mr. George Gibbs, one of the committee, read a paper in which the important engineering problems to be decided by the tests were strongly elucidated. Mr. G. W. Rhodes proposed that the General Managers' Association, of Chicago, should be appealed to for assistance in raising the required funds. This idea was broadened and recommendations made that the American Railway Association, which is composed of the leading railroad managers in the country, should be requested to co-operate in securing funds for the purpose of making tests at the Purdue University. This Association met in New York on April 11. Four members of the Committee on Standard Tests of Locomotives were present, viz.: Messrs. J. N. Lauder, R. H. Soule, Angus Sinclair and F. W. Dean. Col. Haines, president of the American Railway Association, gave cordial support to the committee, and through his good offices Mr. Lauder was permitted to address the convention and urge the importance of the work to be done. A petition was presented asking for assistance to the extent of $5,000 annually until the more important tests should be carried out. The application was very favorably received, and a committee was appointed to take the matter into consideration. There now appears to be good prospects of the required funds being forthcoming, as the American Railway Association can assess the different railroad companies for the money in proportion to their mileage.

Getting to Mexico—Wayside Notes.

[illegible]

Americans who invade Mexico should seek the capital over one highway and retreat over another, thus seeing more of the country. I am assuming that all Americans are like myself, inquisitive enough to want to see all they can for their money.

I resolved to reach the Mecca of the Aztec republic via the "Laredo Route," and on a spring morning I left New York over the B. & O. for Cincinnati.

THE B. & O.

[illegible] no recommend at my hands. It [illegible] the first road of importance in America, and the only one of the originals that [illegible] grown, improved, and never changed [illegible] name, purpose and energy. It is rich with history, not only of the science of railroading, but the life of our country. From Washington west its banks, and [illegible] and cuts, its old stations, yea, some of the very old engines you see to-day saw [illegible] bloody battles that the brothers of this land fought one with the other.

There are old earthworks thrown up here and there, and notches cut in their [illegible] at regular intervals tells where the mouths of some grim dogs of war stood and [illegible] forth their hell of death and destruction in shell and canister. Was it a Federal battery that stood here under "Old Glory," that with every shrieking [illegible] proclaimed emancipation and the Union forever? or was it Confederate [illegible] shotted with British shell standing beneath the Stars and Bars, demanding assent to the doctrine of State Rights, the establishment of a new nation of freedom—freedom for the white and eternal [illegible] for the black man? You do not [illegible]. But you do know that peaceful [illegible] and spreading oaks are growing [illegible] the old ramparts; you know that [illegible] young life fed upon the blood and [illegible] the brave men on both sides, that a [illegible] field of winter wheat covers the meadow below, where that desperate charge was made, and as the train whirls you away you see a child asleep under the trees.

As you pass Harper's Ferry, dull and dead is your imagination if you don't see "John Brown's soul go marching on." Look quick as the train passes the old Armory building, and you will see plainly the stone foundations where once stood the machine tools; yes, and there are the old bolts imbedded in the masonry that once held them in place; and if you remember your history and shut your eyes you can see the soldiers in gray as they tear these machines away, load them upon the cars on the very track you are riding over, and send them away to make arms for the Confederacy. The heights above the town again are peopled with an army, now gray, under the intrepid Stonewall Jackson, now blue, under Pope or Burnside.

The bridge over the Potomac is historical. Can't you see it burn? Don't you see the picket line of blue on one side and gray on the other? Your blood tingles, you are about ready to enlist on one side or the other, when the owner of the road appears and announces that "Dinnah is now reddy in de dinin' cayr."

You notice the new engines and trains, as fine as the finest, the great improvements in the roadbed, and say again that every American ought to ride over the B. & O. once in a lifetime anyway.

THE QUEEN & CRESCENT.

I am not writing descriptions of roads or shops. I'm trying to get to Mexico, but I can't help dropping off now and then to see old friends or try to make new ones.

Perhaps you know that the Q. & C. road is made up of six smaller systems, its northern terminus being at Cincinnati and its southern at New Orleans, while a southwestern line extends across part of Alabama all of Mississippi, and Louisiana to Shreveport on the Red river.

I visited an old friend in Geo. W. Cushing, at the Ludlow shops of this road, just across the river in Kentucky.

These shops are rather small, the force light, and only working forty hours a week, yet they are making good progress in putting the power in shape.

Like many other roads, they are doing the necessary work and leaving the frills for a more prosperous time. Running gear is put in good condition, boiler work well done, and plain paint put on. They omit polish, brass trimming, etc.

This company is running quite a number of compounds, but it's utterly impossible to get any information about them here or anywhere else. The way to close the conversation with an official is to ask a pointed question about compounds, and he will shut up like a clam and remark that it looks like rain.

I noticed one improvement going on that is worthy of imitation. Most of the engines in the shop had loose tail-pieces across the frame. This is a common trouble, yet in most shops they take them out, dress out the slots in frames, weld a piece on the tail-piece at each fit, plane it up and refit it—just as it was in the first place.

Of course the tail-piece takes all the strains and shocks due to the engine's work or the handling of the train, and without a doubt they work themselves loose in the frames because they spring, and they spring because they are light. Mr. Cushing is increasing the thickness of these tail-pieces between the frames, so that there is no possible spring to them makes a fit in the frames, and they stay put.

Here, as all over the South, I noticed a great many New York air-pumps. I did not ride over the Q. & C. until I left Birmingham for Shreveport, but went south over the

LOUISVILLE & NASHVILLE.

At Louisville I visited the prince of good railroad men in the person of Pulaski Leeds, superintendent of motive power and machinery.

With him I visited the shops at Louisville, and interesting old shops they are.

CARS WITHOUT PLATFORMS.

The first thing of interest noted was the express and mail cars of this line, built without platforms. Mr. Leeds is a strong advocate of this style of equipment, and seems to have all the argument on his side.

Platforms do no earthly good on these cars, cost money to build and keep up, increase the length of train, are weaker than a no-platform car, furnish a place for tramps, cinders and train robbers to ride, and are of no use.

He shortens the hood of the car and places the usual platform timber against the end sill, does away with steps, platform and railings. By this construction, a very strong car can be built; it is less liable to break up in case of accident and is cheaper. When a railroad can get a cheaper, stronger and better thing, you'd think they would be suited to a queen's taste. Is there any reason for keeping up platforms on mail, express or baggage cars?

NO DRAGGING AIR-HOSE.

Mr. Leeds has prevented the dragging of air-hose on rear of tenders in a very simple and effective manner; he has taken off the angle-cock at rear of tank and put on a finished dummy coupling, that closes the hole when coupled into hose-head. When an engine is cut off a train, the engineer blanks his valve and stays right there until that hose is hung up—brake set till this duty is performed.

AN ADJUSTABLE FRONT END.

On one of the engines an experiment is being tried. A plate was fitted into the front end and held by four long screws passing through the smoke arch front. Starting at the full size, this plate was moved back an inch at a time, and the influence on steaming noted, not for a trip, but a week or so. It was tried back as far as 12 inches, but the best results was had when the plate was 9 inches back of the door. Further experiments has confirmed Mr. Leeds in this, and the intention is to shorten the fronts of this class of engine 9 inches. Surely this is a simple, sensible way to "figure" out the proper length of smoke arch.

TENDER ARRANGEMENTS.

Improvements are noticeable in the tenders; wider coal space in front and inclined coal space, brake-staff on the right side, and no goose necks. Both injectors are on the right-hand side of the engine, and both water-hose on the right hand side of the tank. This arrangement will be shown in a future number of this paper.

The back side windows of the cabs let down, like a street car window, and the cabs have a free story and trailing sash to keep them cool.

AIR-PUMPS.

Mr. Leeds believes that there is the same necessity for two air-pumps that there is for two injectors, and he is fast putting two on. One is set to supply air, as usual, the left-hand one is not started by its governor until there is a main drum reduction of five pounds. Both have steam on then, and both are attending to business. All at once the regular pump breaks down; the engineer don't care a straw; he don't have to do a thing but keep his head out of the window, with his eagle eye on the next signal; the "understudy" is pumping in the "star's" place.

ROUNDHOUSE SHOPS.

In every roundhouse on the system they are putting in a little machine shop, those where large shops are located as well. They build a neat little 10-horse upright engine to drive them, and put in two lathes, a drill press, small planer or shaper and grindstone. These save lots of running to shops and taking regular work out of tools to do odd repair jobs. This looks like a very wise move on roads with shops many miles apart. It will save lots of telegraphing, writing, and waiting for pieces that don't fit when they come.

COUNTERBALANCING.

All through the roundhouses can be seen engines with heavy counterweights bolted into their wheels. They are weighing every driver on the system, and putting the proper weight in it, adding as high as 600 pounds to some wheels and finding a difference of many pounds in wheels on the same axle.

I went out of Louisville on an engine—and a trim, snug, 10-wheeler she was. I noted that while the four-bar guide was retained the two top guides had become one, about a foot wide; this keeps out dirt, and gives the largest possible bearing where needed.

Mr. Leeds has recently commenced to brace the outside of his guide yokes to the side of boiler as was done long years ago. It was a practice that should not have been discarded.

NEW DECATUR

is one of the "boom" towns of North Alabama. It covers about half a county, and has a large building of some sort on almost every block (two-thirds of these are empty), and the rest of the block vacant.

There are miles of graded but unimproved streets, thirty-three miles of water mains and over five hundred fire hydrants.

I enjoyed the exercise of walking a mile and a half alone to the "Tavern" through the mud at 1 A. M. This hotel is big enough for nine towns just the size of this. I ate breakfast with a real estate man who still hangs on.

"Pretty quiet here, now?" I ventured by way of opening conversation.

"Quiet? say, you ort to see Sheffield. Well, sir, it's dead; why last fall a cow wandered into a $10,000 house there. The wind blew the door shut and the cow died of starvation. They never found it out till last week. Yes," he mused, "it ain't what it was. Why, sir, them lots right over ther sold for $500 a front foot—now! well, what we want is Northern capital."

The shops of the L. & N. at this place is the only evidence of real life. Here are the finest shops on the system, and I doubt not in the South. Splendid buildings, good tools, and 700 men at work.

General Master Mechanic Beckert keeps a clean house and yard—if he'd been born a woman, what a housekeeper he would have made! Every cinder in that immense yard seems the same size as its neighbor and just so many to the inch.

The only dirty thing I saw was the freight engines, and they are only allowed to wipe them once for every 1,000 miles run.

The car shops here are well equipped—they have built fifty freight cars in twenty-two days after receipt of order. Everything is in order, everything goes ahead at a uniform gait, and "the old man keeps his eye on everything."

I rode on an engine again almost all the way to

BIRMINGHAM.

This is a brand new Pittsburgh, asleep. Evidences of industries are everywhere. Almost every railroad in the South has a line to Birmingham. We stopped for not less than a dozen railroad crossings in entering the city. Steel works, furnaces, mills, foundries and smelters, rear their smokeless stacks everywhere. Very few of these vast new hives are running. The town seems as if there was a big funeral going on and it was Sunday.

They, too, are waiting for Northern capital—or a let up in the times. One man expressed a feeling I found pretty prevalent: "If Congress would only die off or go home."

The hills around Birmingham are made of iron and coal, and a great manufacturing city must eventually flourish here. I waited not for the boom or to see the railroad shops—I was headed for Mexico, and I took the night train for Shreveport.

I don't know what we passed in the night, but all the next day we rode through a low, flat country, much overflowed with water from the recent heavy rains, and peopled in a large majority with the sons of Ham.

The only let up on the trip is the boarding of the boat at Vicksburg and the ride across the river.

Here, again, war memories crowd the mind.

We rode, mile after mile, straight away through fertile country. It seems a pity that there is not more immigration of thrifty white people to this section; but it will take years to drain the swamps and make it fit for farming; yet it's a thousand times better than the arid lands of the Dakotas, that have cost such a world of work and worlds of disappointments.

Shortly after dark we arrived at Shreveport, La., had time to eat, and climbed aboard a Texas & Pacific train for

MARSHALL, TEX.,

the headquarters of the mechanical department of the T. & P. road.

Here we found no evidence of hard times. The pay of road or shopmen had not been cut, and the force and the hours remain the same as before the panic, while business seems to keep up in a remarkable degree, there being considerable movement of live stock.

Superintendent of Motive Power J. W. Addis has made many improvements in and around these shops since he took hold, less than two years ago. All about the place are evidences of former wasteful methods. Last year the mechanical department ran full force full time, and still saved $195,000 over the yearly expense of 1892.

Slowly tools are being relocated, material placed where wanted and where the first move will put it upon the tools.

The buildings are large enough and good enough, but were very badly arranged.

It seems to have been the plan long ago to throw away things that did not just suit. Some 17x24 eight-wheelers, with less than a year's credit to their service, were scrapped and stood outside of the shop for more than ten years; these have all been repaired but two—good engines being made of them.

I don't know of a road except the T. & P. where the under-side of the wheel covers is always wiped clean; it's done here simply because the under-side of wheel covers is painted a bright vermilion; you never have to tell a wiper to clean a spot that is painted bright red, just try it once on a truck wheel, a wheel cover or a sand-pipe—anything that's always dirty.

The T. & P. have suffered two bad boiler explosions lately—new radial-stay boilers on a class of heavy engines. The officers of the road have been somewhat worried over the matter, have put some extra stays in the side sheets, and have doubted the strength of the single-riveted mud ring for large boilers carrying 160 pounds to the square inch. From what I could learn among "the boys" there are still some of the old devil-may-care sort of railroaders down in Texas, they imagine it's brave to have the reputation of "not bein' afraid of steam" and desirable to show that they are fine engineers because they can "tote more cars without doubling" than anyone else. These men do not hesitate for a moment to screw down pops, falsify gauges and "get there." I am told the two unfortunate engineers who lost their lives in the two explosions spoken of were noted for carrying "a hundred-and-enough," and I have little doubt that excessive pressure caused the rupture of these boilers.

The T. & P. have lots of N. Y. brake equipment.

Mr. Addis is getting his passenger cars into first class condition, and they will show up well with the best.

A new boiler-house and a new brass foundry are just being completed. A power plant attached to the transfer table and numerous other improvements made.

A new place to store parts of locomotives undergoing repairs is provided here. There being little room in the shop, parts have always been placed outside and between the stall doors opening on the transfer table. As there was no way to limit this space, the parts were often left in the way, and were liable to be carried off. This has been helped by building a neat little room between each pair of doors, covering same, and putting on a locked door. Parts are kept in order and safe, do not show, and are out of the shop. The little storerooms being nicely painted look all right.

I journeyed south over the T. & P. to Longville and there took the

INTERNATIONAL & GREAT NORTHERN

for Palestine, Tex., where the main shops of the road are located.

I found Mr. F. Huffsmith, who is mayor of the town as well as general master mechanic, hustling up a subscription to feed a squad of sixty "Commonwealers" who had captured an I. & G. N. train the day before and rode into town. The I. & G. N. is the best equipped road in Texas. They have fine engines, fine machine tools and original ideas. Here you will find a large detached shop used for a tool-room, and it's a good one. In it are first-class tools in the shape of lathes, millers, etc., and also a Brown & Sharp grinding machine, Pratt & Whitney center drill and countersink, tools not often seen in railroad shops, but ones that pay to own, however.

All the shops are clean; the tools in each shop being driven by independent engines. The locomotives cannot fail to attract attention at once, they are the finest looking engines anywhere, the frames are noticeable at once for their size, the boilers are much larger than those in general use for the size of cylinders and are what Mr. Huffsmith calls his compounds. These engines have pulled light passenger trains and made eighty-one miles to the ton of coal.

The tender trucks are extra heavy, and every piece about the machine so heavy and solid that, now, after two years' continuous service, they show no signs of loose joints or other infirmities that mills are heir to beside the usual wear.

The jaws of these frames are some four inches longer than usual. They run over a rough road, and Mr. H. does not propose to have any boxes striking on the binders.

Bronze driving boxes are used. I saw a set that were taken out from under a passenger engine with over two years running to her credit, that did not need a single bit of work done on them. They will easily last until the engine is rebuilt again, and then the six will make five new ones, bronze is so much stronger, and requires so much less work to fit up, that it's a wonder any road will try to get along with the old shell-brass cast-iron affair.

Krupp crucible steel is used for tires and rods throughout.

They use a lead packing of their own for valve-stems, etc., that is poured into the gland, and it does remarkably well.

Mr. Huffsmith believes in every comfort for the engine crews—good seats, cushions, and arm-rests, are provided, and everything in the cab is made as handy as possible.

The Leach sander is used, as is also the Boyer speed-recorder.

They put a small nipple back of the rear drivers and connect to a small surface cock, these are used to clean off the rail after using sand heavily on a grade; the men claim that they can get two cars more over some of the hills by using this jet, it keeps the sand from getting under the train and the hot water lubricates the rail enough to prevent flange cutting.

No cut of wages has been made on this road. The men seem happy and contented, many of them having business interests in the town or along the road, appreciate their jobs and take care of them.

The lower end of the roads runs through a long stretch of sage brush desert, and at last brings up on the banks of the Rio Grande river at the hot, dusty, straggling, half Mexican town of Laredo, of which I shall tell you more in my next letter.

J. A. H.

Improved Angle-Cock.

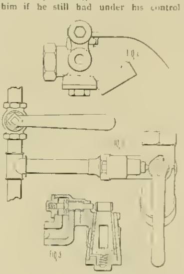
BY E. P. BISHOP

The various accidents that have been attributed to the accidental or malicious closing of an angle-cock have attracted considerable attention to this valve and its weak points. That it stands in need of some safeguard is conceded, and only a short time ago one of the roads in this vicinity had a train leave a terminal with brakes cut off behind the tender. The cutting out of the brakes is too serious a matter to allow to go undetected until it is time to apply the brakes. To provide an indicator that will notify at once the engineer of the closing or even partial closing of an angle cock I have devised and applied for a patent on an improved angle-cock that will accomplish this purpose, I think fully, and I shall be pleased to see the criticisms of our air-brake friends upon it, for if it has any weak points I wish to know them.

Fig. 1 shows the angle-cock connected to signal-pipe by a short branch pipe. In the upper part of angle-cock there is located a valve whose stem extends out close to handle on angle-cock, but does not touch handle when angle cock is open. The closing of the angle-cock brings an eccentric shaped lug on handle in contact with this valve stem, of what I may term the signal-valve, forcing the valve from its seat and allowing air to escape from the signal-pipe.

This reduction of signal-pipe pressure blows the signal whistle, attracting at once the attention of the engineer. This alone would not be sufficient as it would be liable to confuse the conductor's signals. In Fig. 1, the signal-pipe is tapped and a pipe run from it to a gauge on engine.

This gauge stands normally at signal-pipe pressure, but upon the closing of an angle-cock the gauge drops back to nothing, for the signal valve in angle-cock is so designed as to be able to exhaust pressure from the signal-pipe faster than the reducing valve can supply it. The branch pipe to signal-pipe, Fig. 1, is connected to signal-pipe outside of or to the rear of signal-pipe stop-cock. This method of making this connection is to provide for the rear end of train, for in that case the signal-valve, although raised from its seat is inoperative. Should the engineer be notified by the whistle and gauge that an angle cock had been turned he would then have some chance to provide for the safety of his train. A test of his brakes at once (by "feeling" of them) would tell him if he still had under his control



enough brakes to make the next stop safely. If he found that the safest course was to stop at once, he would "call for brakes." The conductor, upon hearing this signal, could at once get an idea as to what was wrong by simply pulling the signal cord in coach. If he did not get a blast of air from the signal-valve in coach he would know that the engineer had lost control of his brakes, and would also know that the brakes could still be applied by the use of the conductor's valve. By this means it will be seen that any disarrangement of the angle-cocks would be known almost instantly by the two men in charge of the train, and they would then be in a position to take some intelligent means to provide for its safety.

Incidentally, the placing of a gauge on the signal-pipe will also insure the reducing-valve being kept in good order, and not being allowed to overcharge the signal system until the engineer has to report, "Whistle blows when brake is released." This innovation would, at least, be appreciated by the man who at present is required to test the signal pressure with a gauge and section of hose hung to it.

Mr. P. Leeds, superintendent machinery of L. & N. R. R., has given orders to equip the Birmingham Decatur train and engine with this valve.

Uneven Wear of Tires.

BY W. DE SANNO.

While Purdue University, of Lafayette, Ind., is wrestling with the problem of counterbalancing in locomotives, in a practical way, they seem to be throwing some light on this much vexed question, and it begins to dawn on the minds of skeptics that the "hammer-blow" man may be right after all.

The above remarks may not be pertinent to the subject matter of this article, but it does prove that there are some things in connection with locomotive service that will stand considerable investigation. Broken straps, sheared rod bolts, broken and bent rods, and pins. These are only effects that follows cause. Now, what is the cause of these breaks? While doing some wheel work on the big lathe in a shop where I once worked, and in looking for the smallest wheels for the first turning, and noticing the great diversity in sizes, the writer put on his thinking cap, which resulted in the conclusion there must be a vigorous give and take, that the connections must resist, and this resistance in a heavy multiple-coupled locomotive is very severe, and calls up some questions in traction and adhesion that might well be looked into.

By the use of a steel tape line around the badly worn tires of a consolidation switch engine, I found the following diversity of sizes: No. 1, 12 ft. 7¼ in., No. 2, 12 ft. 7¼ in., No. 3 (main wheels), 12 ft. 7½ in., No. 4, 12 ft. 7¼ in., being ½-inch between the largest and smallest wheel in circumference. We will put the engine in the position shown in Fig. 1, with pins all in tram on lower quarter. Now let us take off the rods and roll the engine ahead one turn, when the pins will assume the position shown in Fig. 2. Wheel No. 2 will assume its normal position, while the pins of 1, 3 and 4 will be back of the center. We must now assume the main wheels to be the prime movers or driver, and the rest the driven when coupled together. Here we have the engine in service with the main wheels ¼-inch larger in girth than the front and back wheels, but ¼ inch smaller than the No. 2.

It now follows that while the number of revolutions are the same, the rim speed must vary by virtue of a difference in size. Hence the main wheels, being larger than the front and back wheels, it has a greater rim speed, and if such is the case, the front and back wheels are not pulling, but slipping in such a way as to destroy their pulling qualities, unless it can be proven that the smaller wheels in this case are doing the pulling and the larger ones doing the slipping. Again, the No. 2 wheels, being larger than the main wheels, have a still greater rim speed, but by virtue of the rod connections they must be slipping in their efforts to roll faster than the smaller wheels. The engine quoted used sand at both ends.

Therefore it is not only the sand that

Fig. 1

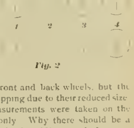


Fig. 2

wears the front and back wheels, but the constant slipping due to their reduced size. Those measurements were taken on the right side only. Why there should be a variation in the size of Nos. 2 and 3 I cannot explain, unless the main wheels being the heaviest. It would be much gained in the life of the engine if the wheels were turned oftener to keep them of a uniform size, even if the boxes, shoes and wedges were not touched. The defects mentioned in the above article is a strong argument in favor of solid end rods.

I wish to put this question to some of the readers of LOCOMOTIVE ENGINEERING. Suppose we load an engine with 10,000 pounds of iron to be placed above her frames or above her driver bearings. She will now pull a given load. Now let us remove this 10,000 pounds and make her drivers 15,000 pounds heavier, will she pull the same load as before? The engine has no truck wheels.

Long Fast Run.

A correspondent in Galveston sends us the following

A few weeks ago there was a special banana train left Galveston over the Gulf, Colorado & Santa Fe and Atchison, Topeka & Santa Fé Railways, for Chicago, making such fast time that it was generally commented on by the press, and pronounced by several railway officials as the result of an accident that could not be accomplished again. The run was considered the best on record, but we did not boast on the Santa Fé. We were not running against time, and knew we could do better The total number of hours consumed in making the run from Galveston to Chicago was fifty hours On the Atchison they made fastest time. Comments were so numerous that the management desired to make a record next time.

The record-breaker left Galveston February 28th, Engine No. 5 cylinders 16x24, Engineer Wagner, Fireman Harris The train weighed 334 tons Some time was lost going through the yards and crossing the two-and-a-half-mile bridge over Galveston Bay The distance from the west end of the bridge to Sealy is 90 miles Time consumed, 2 hours and 23 minutes, speed, 37 $\frac{14}{100}$ miles per hour The grade on this division is light

At Sealy, Engine No 82 an 18x24 mogul, Engineer Haley Fireman Stacey, took the train The distance from Sealy to Temple is 124 miles, grade 1¼ per cent Time consumed, 3 hours and 57 minutes, average speed, 31 $\frac{4}{10}$ miles per hour.

At Temple, Engine No 340, 17x24 8-wheel, Engineer Cowart, Fireman Rhinesmith, took the train to Cleburne Distance, 99 miles, grade, 1¼ per cent Time consumed, 3 hours and 6 minutes, speed, 31 $\frac{93}{100}$ miles per hour

At Cleburne, Engine No 54, a 17x24 mogul, Engineer Anderson, Fireman Weeks, took the train The tonnage was reduced at this point to 270 tons, two cars going over the "Frisco" to St Louis. This division is 93 miles, grade, part 1¼ and part 1 per cent Time consumed, 2 hours and 34 minutes, speed, 36 $\frac{28}{100}$ miles per hour.

From Gainesville to Purcell the train was hauled by Engineer Ready, Fireman Coombs, with Engine No. 187 Distance, 107 miles, grade, 1 per cent Time consumed, 2 hours and 48 minutes, speed, 38 $\frac{21}{100}$ miles per hour

The figures given are accurate Mr George A. Hancock, superintendent of machinery, rode on the engine or train the entire distance from Galveston to Purcell, and took the actual running time exclusive of delays. The distance is 1,385 miles We feel proud of the record made, as it is said to be the fastest long-distance freight run ever made in the world

For some years after the extension smoke-box for locomotives first appeared there were numerous patents obtained for combinations calculated to improve the box as a spark-arrester, or to perform some real or imaginary function which the common arrangement failed in. This line of invention led to the wasting of money by people ill able to afford squandering their means on patent office fees, and it fell into innocuous desuetude for a few years, but the infection to improve smoke-boxes is spreading again. Half-a-dozen patents have been taken out within the last month for the improvement of the locomotive smoke-box We only hope that the inventors will be more fortunate than their predecessors. Railroad companies are not ready to spend money on draught obstructors these days. They got too many lessons when the period of fearful and wonderful smokestacks of the kind that trainmen, for good cause, called ice cream freezers was passing The man who promises to save 20 per cent of fuel by an improved smoke-box is sure to get left. Superintendents and master mechanics will not listen to tales of that kind.

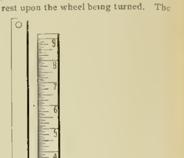
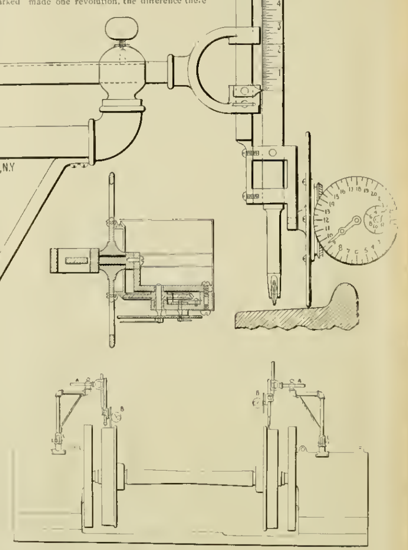
Circumference Indicator and Tire Gauge.

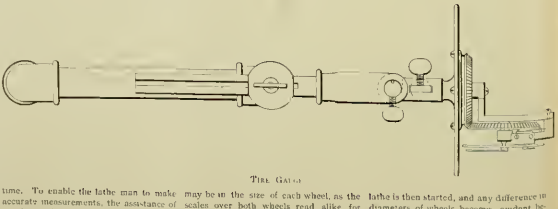
BY P. M'[illegible].

In the Como shops of the Northern Pacific Railroad, there has been in use for about three years, an attachment to wheel lathes by which the size of wheels can be quickly and accurately determined. It is called a circumference indicator and tire gauge. Hitherto in turning down wheels reliance has been placed upon an ordinary caliper to determine the size of the respective wheels Calipers adapted to this use must necessarily be large, and as a result, the flexibility of the metal of which they are constructed renders them to a certain extent inexact and unreliable In taking the circumference of a wheel during the process of turning the lathe must be stopped and opposite points marked on the head of the tire at equal distances from the face of the wheel, the points so marked to serve as a guide for the calipers. This process must be gone through with as often as measurements are necessary, which causes great loss of time. To enable the lathe man to make accurate measurements, the assistance of another workman, who must be taken from his regular work, is required, making an additional expense.

This invention dispenses with this inconvenience, as will be readily seen from the accompanying drawings. The essential parts of the apparatus are, a scale provided with a small roller at its lower end for contact with the wheel, and a second piece of mechanism, consisting of an indicator wheel or disk supporting a suitable indicator by means of a small gearing. The whole is mounted upon a right-angled, removable bracket secured to a support. The brackets are made of gas pipe and are sleeved at their lower end over fixed projections. The scale, with the small roller at its point, is used for getting the size of the first cut on the wheel, and is placed in the groove made by the tool when it begins to cut. As the wheel is making its first revolution the cut is being started on the other wheel and the roller placed in the groove, as in the case of the first wheel. The operator at a glance can see when each wheel has made one revolution, the difference there may be in the size of each wheel, as the scales over both wheels read alike for equal diameters.

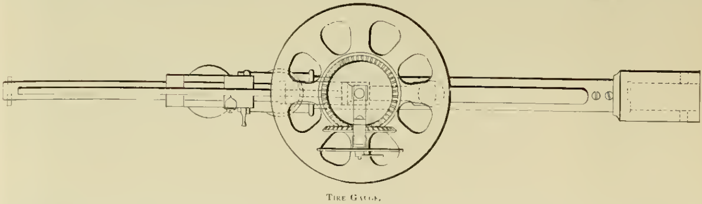
The circumference gauge is for taking the circumference of the wheels after they are finished and before they are removed from the lathe; or it can be used before they are finished, when the tool has traveled across the face of the tire sufficiently to allow the indicator disk to rest upon the part of the wheel that is being turned. Before beginning to take the circumference of the wheel, the pointers on the dial are brought to the zero mark and the circumference wheel or disk allowed to rest upon the wheel being turned. The lathe is then started, and any difference in diameters of wheels becomes evident before the revolution is completed, and the longer it runs the greater will be the difference between the dials. As can be



TIRE GAUGE

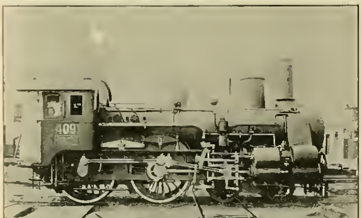
seen from the accompanying drawings, the device can be swung around out of its position, thus giving the workmen a better chance to chip the wheel if it is necessary The device is a great benefit also when the records are kept, as it shows the size of the wheel before and after turning It is claimed for the gauge that it saves about 15 per cent in time of turning steel-tired wheels; that it gives the most correct size possible, is very easily handled, and is cheap and simple in its construction



TIRE GAUGE.

Swedish Compound Locomotives.

The locomotives hereby illustrated will interest our readers for several reasons. They have been built in Sweden for the government railroads of that country, and are notable from the fact that they so closely resemble the American type of locomotive. Both are compound engines with outside cylinders, one of them having tandem cylinders, and the other high-pressure on one side and low-pressure on the other. The 8-wheel engine has high-pressure cylinders $12\frac{1}{16}$ and low pressure cylinders $19\frac{7}{8}$ inches diameter. The stroke of both pistons is $25\frac{19}{32}$ inches. The driving-wheels are 6½ feet in diameter, and the truck wheels 42 inches diameter. The boiler is of steel $\frac{9}{16}$-inch thick, the barrel being 51¼ inches diameter. There are 158 2-inch tubes, total heating surface of tubes and firebox is 1,452 square feet, the grate surface being 32.2 feet. The engine in working order weighs 59.96 tons



SWEDISH LOCOMOTIVES.

The 6-wheel engine has a high-pressure cylinder $19\frac{5}{8}$ inches diameter, the low-pressure being $27\frac{9}{16}$ inches. The stroke is $25\frac{19}{32}$ inches. The wheels are 56 inches diameter. The boiler is nearly of the same dimensions as the other one. This engine weighs 46 35 tons.

All the valve motion connections are outside the frames, the Walschaert motion being employed. The engines do not appear to be models of simplicity.

The Hard Road of Self-Instruction in Engineering.

It has been my privilege several times to listen to addresses made to students of engineering schools by self-educated engineers, but I have never before ventured to fill the position of speaker in a meeting of this kind. When listening to old engineers telling the rising generation about the methods they employed and the courses they followed to reach the higher planes of the profession, one peculiarity has struck me as being open to criticism. That is, the egotistical assumption, so often made, that a man who works his way upward from the vise bench or the anvil, from the fireman's scoop or from the axe of the survey without the aids of college training must necessarily be a better engineer on that account. Self-made men are said to be peculiarly prone to worship their creator.

It is very natural that a man who has climbed to a high altitude by a certain road, and witnessed many failures by men apparently better equipped than himself, should conclude that the path which he followed was the best route. After he has long rested on the summit he forgets the roughness of the path traveled and the hard toil of the ascent. The obstacles which were surmounted by hard, tedious labor and the devious courses followed in which precious time was wasted, are forgotten. The goal reached satisfies the aspirations of ambition, and the rocky road traversed is remembered only as a picturesque route. It is wonderful to witness the capacity displayed by some people in forgetting the sting of hardships they have passed through.

I met an old marine engineer named McIntosh the other day who was once a shipmate of mine on a steamer which had the boilers so loose that they bumped on the side every time the vessel rolled, and she rolled often and frightfully. The bilges were filled with rotten grain, which made the vilest smelling mixture. This abominable stuff choked the bilge pumps every hour or two, and the wretched engineer on watch sometimes had a bath in this odorous bilge water before he got the pumps clean, so they would discharge the leakage which threatened to swamp the vessel.

My old shipmate is of the pessimist class who see everything of to-day black as compared to the doings of yesterday. He believes himself opposed to modern marine practice and gazes lovingly on the doings of long ago

We were recalling our old experiences on the *Helen*, of Glasgow. It was not a rosy period of my life. I spoke of the cracked steam-pipe which squirted steam every time the boilers moved. We all knew that if the pipe broke off every soul under the decks would be scalded to death instantly. I recalled the constant dread, the horror of seeing the crack gradually lengthen, and the grim jokes about how different members of the crew would look five minutes after the pipe parted.

McIntosh agreed that it was a little uncomfortable, "But, man Angus," he said, "it was fine to go on deck at the end of a watch, and feel that you had finished another turn below without getting cooked."

I recalled the disgusting baths we got while cleaning the bilge pumps. "Yes," he admitted, "that was nasty, but it learned you to know what a good thing a change of clothes was. Then it was some pleasure to know that Fraser was having his turn." McIntosh looked on Fraser as a fop, and there was something incongruous about a fop bathing in our peculiar bilge water.

I have never been able to convert past hardships into pleasant memories. Perhaps it is owing to this turn of mind that I always have been envious of engineers who have enjoyed the good fortune of starting upon their life's work with a good scientific education. An engineer to be worthy of the name must in some way acquire a great deal of accurate knowledge of various kinds. The first requisite towards obtaining this capital of professional lore is mental discipline. The next is guidance in acquiring the right kind of information. My own experience leads me to believe that the young mechanic who starts out determined to become an engineer, will waste no small part of his energy in the wrong direction through want of the discipline and the training which the engineering school supplies.—*From lecture delivered by Angus Sinclair at Sibley College, Cornell University*

Cleaning by Air.

The methods of cleaning cars by the use of compressed air have been extended greatly in the last year. It is found that the work cannot only be done much more expeditiously than by the brush and rod or fuss-and-feathers way, but it is done more effectually. Those who interest themselves in sanitary questions say that cars cleaned by the compressed air process are likely to be freer from disease germs than others cleaned on the old plan. This idea has taken a hold on the popular taste, and we already find some agitation in favor of using compressed air for the cleaning of rooms. A writer in the *Chicago Dispatch* says

"It is now in order for some home missionary to invent some simple device that will work an air-pump and current for household use. Its introduction would revolutionize housekeeping and solve the heretofore hopeless problem of clean rooms, and will keep furniture covers and carpets. It would render less service necessary and would save a large portion of the wear and tear of furnishing textiles. In houses where there is hydrant water it would not be at all difficult to attach an air-pumping apparatus to the kitchen or bathroom faucet and thus furnish power for every floor."

The Elements of Boiler-Making III.

By C. E. Fourness.*

Laying Out a Smokestack.

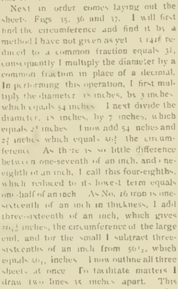
[illegible] constructing a smokestack it is [illegible] make a bend or offset [illegible] [illegible] The stack is [illegible] inches in [illegible] and made of No. [illegible] iron. Fig. [illegible] is a side view looking [illegible] the [illegible] [illegible] [illegible] shows the location of the seams [illegible] general appearance, but is not necessary to have to lay out the parts [illegible]. This view is called [illegible] elevation,

[illegible] elevation meaning [illegible] and is called a [illegible] elevation depending [illegible] shown. In construct[illegible] sheets of iron [illegible] Figs. 32 [illegible] 34, and [illegible] use a sheet 48 inches [illegible] to make the angle as [illegible] and still not be obliged [illegible] special [illegible] of sheet, as sheets [illegible] 48 inches wide are common sizes. [illegible] now construct the outline view, Figs. [illegible] and 34. This view is required to [illegible] the sheets. I first draw the center [illegible] H and C D [illegible] inches apart, and parallel to each other. I next draw the diagonal line B C, Fig. [illegible], [illegible] inches long. I now draw the lines [illegible] and [illegible] inches apart and [illegible] inches on [illegible] side of the center line [illegible]. [illegible] I draw the lines K C F and J B G through the points where the lines meet and cross each other. Upon these lines the holes are placed as shown in Fig. [illegible] I [illegible] draw the line H A I [illegible] inches from [illegible] and the line L D E [illegible] inches from K. This allows ½ inch for lap at the top and [illegible] inch at the bottom, as the sheets are [illegible] inches wide. I next draw a semicircle, as [illegible] 32 and 34, using 9 inches, one half the diameter, as a radius, and setting my [illegible] at about 3 inches I divide each semicircle into ten points, each point representing a rivet hole in one-half the circumference. I next number them from 1 to 10, as shown.

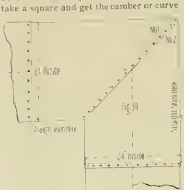
After a person becomes accustomed to laying out work, it will not be necessary to number the ordinates, as these lines are called. The definition of an ordinate in geometry being a straight line drawn from any point in a curve perpendicular to another straight line.

I now draw the lines of ordinates between and just cutting the lines $L\ D\ E$ and $K\ C\ F$ through the points for rivet holes on the semicircle marked 1, 2, 3, 4, etc. I now have Fig. 32 complete. I next draw the ordinates in Fig. 34 through the points on the semicircle and just cutting the lines $J\ B\ G$ and $I\ A\ H$. Next comes the ordinates in Fig. 33. I draw these lines through from where they cut the lines $K\ C\ F$ and $J\ B\ G$ in Figs. 32 and 34. I now draw the line marked center, midway between and at right angles to the center line $B\ C$. This completes the outline view.

Next in order comes laying out the sheets, Figs. 35, 36 and 37. I will first find the circumference and find it by a method I have not given as yet. 3.1416 reduced to a common fraction equals 3 1/7, consequently I multiply the diameter by a common fraction in place of a decimal. In performing this operation, I first multiply the diameter 18 inches, by 3 inches, which equals 54 inches. I next divide the diameter, 18 inches, by 7 inches, which equals 2 4/7 inches. I now add 54 inches and 2 4/7 inches which equals 56 4/7, the circumference. As there is so little difference between one-seventh of an inch, and one-eighth of an inch, I call this four-eighths, which reduced to its lowest term equals one-half of an inch. As No. 16 iron is one-sixteenth of an inch in thickness, I add three-sixteenths of an inch, which gives 56 11/16 inches, the circumference of the large end, and for the small I subtract three-sixteenths of an inch from 56½, which equals 56 5/16 inches. I now outline all three sheets at once. To facilitate matters I draw two lines 35 inches apart. This brings them one-half inch from the sides of the sheets I intend making. These courses of Figs. 35 and 37 and for Fig. 36, I draw the lines 47 inches apart. I next decide which end I intend to make the large end, and locate a lap hole one-half inch from the end of the sheet and the other lap hole 56 11/16 inches along the line. I now draw a center line midway between the lap holes and at right angles to the lines already drawn. I next locate the lap holes for the small end 56 5/16 inches apart, and one-half this distance, or 28 5/32, each side of the center line on the small end.



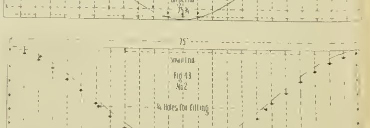
I now space off the large ends of the sheets for 18 holes, and the same for the small ends. You will notice I only require to set my dividers once for the large and once for the small ends of all the sheets. Next I draw the lines connecting the rivet holes, and in numbering the lines in Figs. 35 and 37 the center line will be No. 10, and run down to No. 1 at the straight seam, Fig. 36. As I do not wish to have all the straight seams in a line, I will start with No. 1 at the center and end with No. 10 at the straight seam. This brings this straight seam opposite the others, and I find by referring to Fig. 31 that the small end of Fig. 35 and the large end of Fig. 37 is to be riveted directly to the stack. I will take a square and get the camber or curve

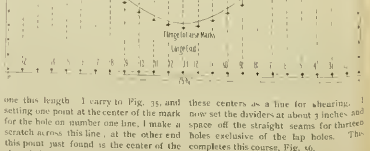


the holes are on by laying it (the square) along the lines numbered 1, 2, 3, 4, 5, etc., as shown in laying out a taper course in a previous number. I will also perform the same operation with the line marked $X\ Y$, Fig. 36. This gives me the line of rivet holes to correspond with the lines $L\ D\ E$, Fig. 32, and $I\ A\ H$, Fig. 34, and the line of rivet holes $K\ C\ F$ I find by setting the trams from the line $L\ D\ E$ to $K\ C\ F$ on the ordinate number one this length. I carry to Fig. 35, and setting one point at the center of the mark for the hole on number one line, I make a scratch across this line, at the other end this point just found is the center of the rivet hole wanted. As there is another number one line I also mark that.

I next find the length of the ordinate number two, Fig. 32, and mark that length on the lines number two of Fig. 35. I follow along in a similar manner with numbers 3, 4, 5, etc., to number 10. After this is completed I draw a line one-half inch outside of the holes for the lap. I then set the dividers to about 3 inches and space off on the number one lines in the space between the lap holes of the straight seams for nine holes, exclusive of the lap holes. This completes Fig. 35.

I now start on Fig. 36. In this course both ends are beveled, so when the sheet is rolled up the ends conform to the angles at which the lines $K\ C\ F$ and $J\ B\ G$ stand. I set the trams on the ordinate number one from the line marked center to the line $K\ C\ F$. This length I carry to Fig. 36 and on the line number one (which is also the center line). With one point at the line $X\ Y$, I make a scratch with the other point across the line at the center of that rivet hole. By setting one point of the trams without having changed the setting at the center line, the other at J, Fig. 33, on the ordinate number ten, I now find it corresponds in length, so I set one point at the line $X\ Y$, Fig. 36. On each of the two lines marked number ten I make scratches for holes. These are at the large end of the course. I again proceed to Fig. 33 and set the trams from the center line to the line $K\ C\ F$ on the ordinate number two. I next try this length from the center line to the line $J\ B\ G$ on the ordinate number nine and I find it corresponds in length. I next set one point of the trams at the line $X\ Y$ on both lines numbered two and make scratches to designate the center of the holes on the small end. Then I transfer this same length to both lines numbered nine on the other, the large end of this same sheet. I next set the trams again from the center line to line $K\ C\ F$ on the ordinate number three and try it on the ordinate number eight from the center line to the line $J\ B\ G$, Fig. [illegible]. This length I transfer to Fig. 36 on the two lines, number three on the small end, and the two lines number eight on the large end, measuring from the line $X\ Y$. All these marks I make across the lines 1, 2, 3, 4, etc., in a similar manner, and they represent the center of the rivet holes. I next draw a line one-half inch outside of



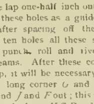


these centers as a line for shearing. I now set the dividers at about 3 inches and space off the straight seams for thirteen holes exclusive of the lap holes. This completes this course, Fig. 36.

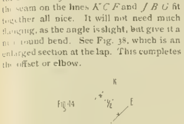
Next in order comes Fig. 37. I will start by setting the trams from the lines $I\ A\ H$

* Foreman Boiler-maker, C., M. & St. P. Ry., Dubuque, Iowa.

to J B G, Fig. 34, on the ordinate number one. This length I transfer to the two lines number one, Fig. 37. I next find the length of the ordinate number two, Fig. 34, and transfer this to the lines number two, Fig 37. I now find the lengths of Nos. 3, 4, 5, etc., and transfer them to Fig 37 as shown, after which I draw a line for the lap one-half inch out from the centers of these holes as a guide to shear by and after spacing off the straight seams for ten holes all these sheets are ready to punch, roll and rivet up the straight seams. After these courses are rounded up, it will be necessary to flange or set the long corner G and K in, and the short end J and F out; this is to make the seam on the lines K C F and J B G fit together all nice. It will not need much flanging, as the angle is slight, but give it a nice round bend. See Fig. 38, which is an enlarged section at the lap. This completes the offset or elbow.



I will next take a square elbow 24 inches in diameter, to be made of No. 10 iron. These elbows are very seldom used at present on account, principally, of breaking the current of whatever passes through—smoke, steam, air, etc., striking against the end and having to seek a new path. Fig. 39 is a side elevation of the elbow complete. Notice that number one course is not flanged at all, consequently I will lay out all the holes in this course. In number two course I will only lay out two, one on each side on the quarter, or on the ordinate C 7, Fig 40 I have on this marked holes for fitting. It is similarly marked



on Fig. 43. In drawing the outline view, Figs. 40 and 41, I first draw the center line A B, then B C at right angles to A B. I next draw the lines F E D and I H G, 24 inches apart and 12 inches each side of the center line A B, B C. I next draw the line D C I, 35½ inches from the corner E. This is the line of rivet holes for attaching to the next course (leaving one-half inch for lap as a 36-inch sheet is being used) and also the line to measure from, for the length of the ordinates I now draw the line G A F 34 inches from E. This allows 1 inch for the flange at E, and one-half inch for the lap at F. I next draw the diagonal line H B E, which is the edge of the lap of Fig. 40, and the line for flanging, Fig 41 I now draw another line, J K, one-half inch from H B E in Fig. 40 for the line of rivet holes. Using the lines G A F and D C I as diameters and A and C as centers, I draw the semicircles which I divide into thirteen points for rivet holes. I next draw the ordinates and Nos 1, 2, 3, 4, 5, etc, to 13, beginning at F and D with No. 1. I then lay out the two sheets, Figs 42 and 43, the circumference of the large ends being 75¾ inches and the small ends 75 inches. I next space them off for twenty four holes and draw the lines across the sheet. Connecting these holes I number them 1, 2, 3, 3, 5, 6, etc, beginning in Fig. 42 with No. 1 at the center and ending with No 10 at the straight seams In Fig. 43 I begin with No. 1 at the straight seam and end with No. to at the center.

The reason for numbering this way is to separate the laps This locates them on opposite sides from each other. I notice, by referring to Fig 39, that the small end of Fig. 42 and the large end of Fig. 43 must be left in shape to rivet to the other part of the stack. Consequently, I must give them the required camber, and when finished I find the center of the rivet on the line J K, Fig. 40, by transferring the length between the lines D C I and J K on the ordinates 1, 2, 3, 4, 5, etc, Fig 40, to the lines with the corresponding numbers on Fig 42 Measuring these lengths from the center of the rivet holes on the small end, and after these are found I draw a line one-half inch outside of these holes for the lap. I now space off the straight seams for three holes. This completes Fig 42 ready for shearing and punching.

Now, for Fig. 43. I transfer the lengths of the ordinates 1, 2, 3, 4, etc, between the lines G A I and H B L, Fig. 41, to the correspondingly numbered lines in Fig. 43. Measuring from the center of the holes already found at the large end, I now mark these points with a center punch to prevent them becoming erased, and to be used as a guide for flanging. I now draw a line 1 inch out from these marks for the flange, then space off for ten holes in the straight seams, leaving the last hole one-half inch from the center marks for flanging I will next mark off the two holes in the center line A B C for fitting, and after the course is rolled and flanged set the two parts together and drive drift pins lightly into these holes on each side, they will hold everything together nicely to mark off the holes

I will now explain how I lay out the holes for fitting in Fig 43. Fig. 44 is a full size view of the part at B. Figs 40 and 41, with A B, B C the center lines and the two diagonal lines are represented, one, H B E, the line of flanging; the other, J K, the line of rivet holes These latter lines are drawn parallel and one-half inch apart The holes are on the ordinates or center lines, C B in Fig 40. This brings them on a line at right angles to A B, and measuring from one diagonal line to the other on the line C B, it measures three-quarters of an inch; consequently on Fig. 43 I draw short lines at right angles to the lines No. 7 towards the center, and from the center mark on that line for flanging. I now locate the rivet holes three-quarters of an inch from the lines No. 7 on the short line.

I will now show a shorter method of making an outline view for getting the lengths of the ordinates for men who are more familiar with this work. I first draw a central line A B. Fig. 45; next the lines C D and E F 24 inches apart and 12 inches each side of the center line A B I now draw the diagonal line C B F, this line is at an angle of 45 degrees to the line C D, the point at F being just the diameter of the course 24 inches from G, and G being on the line C G, which is at right angles to C D. I next draw two lines at right angles to C D, one of them 1-13, 34½ inches, the other D A E, 34¾ inches from C. I next draw a semicircle, using the line 1-13 as a diameter, this semicircle I divide into thirteen points beginning with No. 1 at D. Through these points I draw the ordinates numbers 1, 2, 3 to No. 13. Then the length on these ordinates between the lines D A E and C B F will correspond in length with the length of the correspondingly numbered ordinates in Fig 40, which were transferred to Fig 42 for the rivet holes, and the lengths of the ordinates between the lines 1-13 and C B F will equal the length of the ordinates between the line, the center of the rivet holes and the center mark for flanging in Fig. 41 These lengths were transferred to Fig. 43.

I expect the remark may be passed why not make this elbow of square courses and save the extra work of spacing both the large and small ends, also getting the camber? But if you will stop to consider the courses, Fig 41 is large and Fig. 40 is small, and that the large one must enter into the small one at the angle H B E. Necessarily when Fig. 41 is flanged it would require to be made four times the thickness or one-half inch smaller in diameter to have it enter into Fig 40 This would take longer to flange, as the center marks for flanging would require to be flanged over more at E and not over to the marks enough at H to accommodate the difference in the diameter. This would not make so nice a looking job when finished

Most men, in laying out a cylinder, cut off by a plane at other than a right angle to the axis, Fig. 31. For instance, here we lay out all the holes, and unless the work is performed correctly the holes will not come fair On this we cannot depend upon setting it in or out a little to suit, as is depended upon when the sheet is flanged and the holes not punched, but when the holes are punched, unless they are laid out and punched correctly the man who fits and rivets it together comes to the front with his gauge, reamer and profanity, especially if some one else does the laying out.

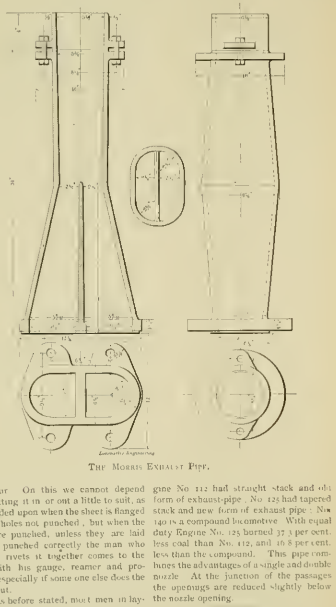
But, as before stated, most men in laying out this elbow would (as most text-books show), in transferring the lengths of the ordinates to the correspondingly numbered lines on the sheets to be laid out, measure from a straight line used to outline and space off the holes on the end, or a straight line drawn at any other convenient point. This is, of course, proper for a square course. But, for a taper course you will readily recognize that the holes are placed on a curved line, so when the sheet is rolled up they are on a plane parallel to the base. Consequently, the lengths, as transferred from the ordinates, should be taken from the center of the holes at the end for attaching to the ordinary taper course to bring everything correct

The definition of a plane in geometry is an even or level surface.

The definition of an axis in geometry is a straight line in a plane figure about which it revolves to form a solid, the axis of a cylinder is a straight line through the center from end to end, the axis of a cone is a straight l[illegible] passing from the center of the base t[illegible] top or vertex.

The Morris Exhaust-Pipe.

The exhaust-pipe here illustrated was designed by Mr W S Morris, superintendent of motive power of the Chesapeake & Ohio, and has been for some time in use on Engine No. 125. The pipe, in a general way, resembles that with which the Committee of the Master Mechanics' Association, which reported on "Draft Appliances" two years ago, obtained the most satisfactory results It has made a remarkably good showing on the C & O. engine Three engines were tested on the James River division to ascertain the relation value of the exhaust-pipe. Engine No 112 had straight stack and old form of exhaust-pipe, No 125 had tapered stack and new form of exhaust pipe; No. 140 is a compound locomotive With equal duty Engine No. 125 burned 37.3 per cent. less coal than No. 112, and 16.8 per cent. less than the compound. This pipe combines the advantages of a single and double nozzle At the junction of the passages the openings are reduced slightly below the nozzle opening.



The Morris Exhaust Pipe.

A curious incident was related by Mr. Jacob Johann, superintendent of machinery of the Chicago & Alton, in remarks made at a Western Railway Club meeting Mr. Johann said that for thirty years he had followed the practice of giving valves inside clearance instead of inside lap with beneficial results He went on "I took up that subject in 1863 with Mr. Hudson, superintendent of the Rogers Locomotive Works, and begged him to send me engines with inside clearance and he declined to do it. We corresponded about three months and he still persisted in having his ⅛-inch inside lap. The road I was with was not very solid financially, we were buying engines with paper, so I could not stand upon my dignity about having the engines just as we wanted them. I finally dropped the subject, and as fast as the engines arrived at my shop the valves were taken up and fixed as I wanted them. When changed they would take two more cars over the hills than they would when they had the inside lap."

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Uneven Performance of Locomotives.

The practice of running locomotives by different crews has done a great deal to dissipate the old fallacy that engines of the same general dimensions, and built from the same templates, varied greatly in efficiency. This belief still lingers on some roads, but it is rapidly disappearing before the march of intelligence, and the conditions which assign all kinds of men to the handling of every class of engines. It used to be common to hear that certain engines were smart, while others were lazy; one would have the reputation of steaming much better than others, and certain engines which would surpass others on a level would be called no good on a hill. It was said that they "ran into" the grade.

Trainmen are earnest propagators of the prejudices which give individuality to every engine. They repeat the unreasoning talk they have heard from others who ought to be better informed, and fallacies become established articles of faith.

There are the best of reasons for believing that the difference in performance which led to prejudices respecting certain engines, was due to the men handling them and not to the machines. One man was always afraid to strain his engine. He would not open the throttle wide, for fear of putting too much pressure upon the slide-valve; he would not drop the reverse lever a notch, for fear of hurting the piston connections. Another man, who is in decided contrast to the first, appreciates the fact that the locomotive is made strong enough to perform any work within its capacity, and he does not trouble himself with a fear of anything breaking should he exert his best to make the engine do all the work within its parts. If this man works judiciously, the engine he runs will gain a name for superior efficiency, and a name once obtained by machine or man on a railroad has astonishing vitality and persistence. Between the man who is always coddling his engine to the best of his ability, and the man who believes in making the machine do its best, there are many gradations of personalities who put the influence of the results obtained upon the character of the engines they handle. When the wide variety of this personal equation is considered, it is not surprising that a firm belief took root that no two locomotives are alike in capacity, no matter if all the parts of the engines are duplications of those on all other engines in service.

Of course, there are sometimes minor defects or distortions which one or two engines may suffer from that may make them less efficient than the others. We have known of one engine in a group that was noted as being a defective steamer and held that reputation for years, although all the others of the class were remarkable for making steam freely. A bright traveling engineer happened to reason that there must be some good cause for this, and a systematic investigation was instituted. This brought out the fact, that the exhaust pipe was out of line. When this defect was remedied the engine steamed as well as any of the others. It would be interesting to know how much fuel was wasted by this engine, because the men responsible for her condition did not reason that something was radically wrong before she was running three months. The habit of thinking, as a matter of course, that one engine was liable to work less efficiently than others of the same class blinded them to an imperative duty.

In another case that came under our notice, one engine never was able to do so much work as others of her class. It was the rule, rather than the exception, for freight engines on the road to be lame, and nothing was thought of this one exhausting as if she did not cut off evenly at both sides.

One day a traveling man who was a mechanical engineer happened to ride on the engine and he concluded that something was wrong with the steam distribution. He induced the master mechanic to let him take some indicator diagrams from the cylinders. It was found that the initial steam pressure on one side was about 25 per cent. less than on the other. An examination then showed them that the steam passage in one side was more than half filled up with metal that had run in through a core collapsing.

Minor causes of certain engines of a class working better or worse than others are valve setting and difference in piston clearance. Where there are not strict rules established about the setting of valves, those having whims on this subject sometimes get the eccentrics advanced or set back to give excessive lead or the reverse. This is almost certain to have a pernicious effect.

We once encountered a curious cause which converted a free steamer into a very bad steaming engine. The engine had been in a collision, and had both cylinder heads broken. She went into the back shop for a general repair, and the foreman concluded that the old heads were senselessly thick so he changed the pattern and made thinner ones. When she was put into service, it was difficult to get her over the road with a fast train for want of steam. The engine was also noted for rough riding and pounding in her boxes, which were new phases in her character. She instantly became a burden and a torture to those in charge. Everything that experience and ingenuity could suggest was tried, with very little improvement. For several months she dragged through her runs, harassing everybody directly and indirectly connected with her condition. One day the roundhouse foreman, who has to stand the blame of many other people's mistakes, groaning in spirit, was contemplating this engine and cogitating upon the cause of her mysterious behavior. He had been running her not many years before, and knew that she steamed well. He had taken several trips on her since she came out of the shop, and was convinced that the complaints of the engineer were well-founded. As he looked at the engine he noticed that the crosshead was not traveling evenly in the guides. Thinking that the piston clearance was not evenly divided, he directed a machinist to disconnect the crosshead and find the striking points. When this was done, it was discovered that the piston had about 1¼-inch clearance. This was what thinning the cylinder heads had brought about. It did not require much penetration to understand that ¾ of an inch too much piston clearance would waste a good deal of steam, and plates were put on to fill up the superfluous space. The foreman was not absolutely sure that the large clearance was the cause of the engine's changed condition, so he did not say anything about what had been done to the engineer when he came to take out his engine. When the engine returned from her trip, the engineer made direct for the roundhouse and asked "What have you been doing to the 317?" "Not much," was the reply, "we made some little adjustments." "You may call them not much," he remarked, "but they are worth more than my pay to the company. Why, she is her old self again, and steams better than she ever did, with half the coal she has been using lately."

Cases like those recorded are well worthy of being published, but they are really very rare. In the large majority of engines that are reputed to work better or worse than others of the same class, the man in charge is the cause of the difference. When it is considered desirable to investigate why any engine makes a strikingly good or bad record, it is always safe to begin by finding out how the man running her does his work.

The practical effect of the practice that some engineers have of coddling their engine was well demonstrated by a series of experiments carried out on a Western road a few years ago. There was a prevailing belief that certain small engines were superior in hauling capacity to some engines with smaller cylinders, and that certain engines were superior to others of the same class. A party of experts were sent out with a dynamometer car and all the equipment necessary to find out the truth about the engines. A first-class engineer and fireman were to handle all the engines. The results of the tests showed conclusively that one engine of a given class was precisely the same as another. It was also demonstrated that the tractive power developed agreed closely with the size of the cylinders. There was a popular belief that certain 17x24-inch engines would pull more cars on a hill than other engines with cylinders 18x24 inches. The tests proved that the latter engines pulled more cars in a proportion close to the original superiority in power.

Getting trains up a grade depends very much on the way the engine is handled. On a long steep grade, a locomotive will take up only the weight of train she can haul on a steady pull. But on the numerous short steep grades to be found on so many railroads, the manner of approaching the same decides whether or not the engine will pull the train over. When the engine strikes the grade the speed may be thirty-five miles an hour, and with the best that skillful handling can do the speed may be reduced to three miles an hour when the summit is reached. In a case of this kind the inertia of the train when it reached the grade had helped the engine.

If the engineer, however, fails to make the engine perform its best, the speed will decrease so rapidly that an involuntary stop is made before the summit is reached. The man who is doing his best to take the train up the grade advances his reverse lever as fast as his judgment says is necessary after the hard pull is reached. The increased tractive effort holds up the speed to the full capacity of the engine, and the train goes over the top successfully. Another man, with a similar engine and train, is thinking about saving his engine, and he does not drop the lever a notch till he realizes that he is liable to get stalled. He is seldom mistaken in his fear. When the trainmen are blessing whatever has caused them the extra labor of doubling the hill, the engineer says that the train was too heavy for old Hannah, and the report is circulated that the 54 is not so good as the 55. Few of those who talk this way are capable of understanding the advantage gained by superior skill in handling.

Departing from Standards.

The tendency of some railroad men to depart from accurate dimensions of parts that are standard is about as great as the tendency of the average human being to stray from the paths of rectitude. For years the engineering journals have been preaching the gospel of interchangeability, and seldom do two or three men stand up to talk in a club or convention without some allusion being made to the advantages of standards, and the making of parts in such shape that one will take the place of another without fitting. The railroad mechanical air appears to be charged all the time with a sentiment advocating standard interchangeable parts, yet the vast volume of sentiment produces but a miserably small harvest of practice.

There has been so much done in the last two or three years to aid those who desire to adhere to standards, that we supposed substantial progress was under way; but we were painfully undeceived in the course of visits made to manufacturing establishments within the last two months. In a brass foundry where car bearings are largely made we were shown nearly a dozen different patterns of the standard M. C. B bearing. In various establishments where they were making M. C. B. standard couplers there were no efforts made to maintain the standard contour lines, without which couplers may not be expected to remain secure in tension with each other. On some roads there still appears to be great uncertainty about the exact size of standard screw threads. The taps and dies in use merely approximate the standard dimensions. When their product is applied to the real standard article it will not go on without destructive strains, or it fits so loosely that it shakes loose on experiencing the least vibration. In many shops all the other so-called standards which imply exact dimensions, are made in the same slipshod manner. The thing is incomprehensible. The real meaning of this condition of affairs is that there are many men in charge of railroad rolling stock who ought to be employed in less important occupations. Keeping the parts of cars interchangeable is one of the very best means for maintaining the operating expenses low. This can be done without any undue drain upon the sources of revenue. Where the operating expenses are made high by the mismanagement that results from multiplicity of patterns, attempts are made to effect saving in wages, and general demoralization of the service is the result.

Eternal vigilance is said to be the price of liberty. This means that every man valuing his individual liberty ought to be constantly on the watch for the insiduous impositions that would soon make liberty a mere by-word. The same principal applies to the performance of conscientious duty in every department of life. It applies very strongly to the maintaining of exactness in mechanical details. There are many men always ready to say, "near the fit is good enough." This loose habit soon ruins the efforts towards interchangeability. To all those who favor this business-like way of having work done, but fail through depending upon subordinates, we would say eternal vigilance is your only safeguard. If you are not prepared to exercise this vigilance, you ought not to be surprised or indignant if another man is suddenly appointed to fill your position.

There is a tendency among some of our most progressive master car builders to try and lead to an agreement on a standard body for a box car designed to carry 60,000 pounds. Nearly all new cars are built of this capacity. The general dimensions vary very little, and there seems no good reason why an agreement should not be reached concerning the details of construction. Mr Marden, of the Fitchburg, is very warmly in favor of this new standard, and his views are indorsed by the ablest men in the country. As a move in this direction Mr. Waitt, of the Lake Shore, favors that the M. C. B. Association unite on standard timbers for a 60,000-pound car. Even this would be an important move in the right direction, for builders, and railroad companies could saw their timber and keep the most important parts in stock, which would insure the use of seasoned timber in new cars. Under the existing confused state of affairs new cars are nearly always built of indifferently seasoned timber, and the cars fall to pieces in a few years. Anything which would effect an improvement in this matter would be of benefit to railroads.

Short and Long Valve Travel.

In his paper on "Steam Distribution for High-speed Locomotives," Mr. C. H. Quereau, engineer of tests of the C., B. & Q., takes a decided stand in favor of long valve travel for locomotives. He says that by this means an increased average cylinder-pressure may be obtained without raising the boiler pressure. If the valve travel is increased without increasing the outside lap, or the outside lap is not increased out of proportion, not only is the port opening increased for a given cut-off, but the port opens more quickly, the result being that the longer travel gives a higher steam-pressure in the cylinders. The longer valve travel gives also a later exhaust opening, later exhaust closure, and a larger exhaust opening, all necesary for high speeds and economy. He then proceeds to show, by diagrams worked out from actual practice, points which seem to substantiate his views. Some particulars are also given of a logy engine, noted as a coal eater, which was cured of her wicked characteristics by changing the valve travel from 5 to 5½ inches.

For years the writer entertained views about valve travel substantially the same as those enunciated by Mr. Quereau, and they were based on precisely the same reasons. Any one familiar with the movement of valves is aware that increasing the travel accelerates the velocity of the stroke, with the result that a better port opening is obtained, while protracting the periods of release and valve closure. It was self-evident that these changes must produce a more efficient use of the steam, and that saving of fuel is inevitable. The troublesome thing about this improvement was that one very rarely found it put in practice, where complaints did not follow that the engines became noted as coal-eaters. This is a result which seemed contrary to all reason, but we have heard the complaint repeated so often and on such reliable authority that we have ceased to advocate long valve travel as a means of improving locomotives.

There was a series of experiments conducted on the C., B. & Q., by Mr. Philip Wallis, about seven years ago, to find out the effect of increasing the valve travel. The records made did not seem to corroborate the data given by Mr. Quereau. The trials were made with various engines on different kinds of service, but in each case the same engine was tested with short and long valve travel. They took an engine with 5-inch travel and tried it on certain work, then they changed the valve travel to 5½ inches and altered the link suspension so that the cut-off could be adjusted. This engine was then put to perform the same service as it had done with the shorter valve travel and the performance recorded. One man handled the engines all the time, and every possible care was exercised to make the conditions of operating uniform. The tests were conducted with much thoroughness, and the deductions drawn from the records were that changing the travel did not make any perceptible difference in the working of the engines. We never regard the findings of tests made with locomotives as absolute proofs, but they are useful evidence. The conclusions of the tests made by Mr. Wallis may safely be put in the scale to balance the opposite conclusions arrived at by Mr. Quereau and others. The experience of men with engines in general service, and the performance sheets, seem to show that increasing the travel makes a locomotive more expensive on fuel.

Locomotive Laboratory for Cornell University.

The attention which the laboratory testing of locomotives has excited all over the country has induced the directors of Cornell University to consider favorably a proposal to build a locomotive testing laboratory at Ithaca at a point where locomotives from three or four different railroads having lines touching could be run in and tests made. The laboratory would, of course, be an adjunct of Cornell University. The work of testing the locomotives would give excellent educational training to the students, and might be made a commercial enterprise that would earn enough money to defray all the expenses required for the laboratory. The plan of establishing a testing laboratory on a commercial basis has, we believe, originated with Dr. Thurston. The remarkable success achieved by this able professor of engineering, in all the enterprises he has advocated for developing the resources of instruction, is a good guarantee that this testing laboratory will prove a success in every respect.

Plans of the buildings required, details of the machinery and apparatus necessary are under consideration, and the intention is to establish a plant which will be complete in every particular. The experience with the locomotive testing laboratory at Purdue University will be of great service to the Cornell University people in working out their plans, but the intention is to make this laboratory much more complete and comprehensive than the other. Mechanical engineers with extensive experience in the testing of steam plants have been studying all possible methods of testing locomotives to make the results as correct as the records of stationary engine tests. Every apparatus than can be devised to make the work perfect will be introduced into this laboratory.

We believe that if railroad companies once began to send their locomotives to a laboratory where they could be accurately tested that the practice would rapidly increase, and that the proprietors of the engines would derive much profit from having the engines started out in improved condition. The increasing introduction of the compound locomotive appears to have created a demand for more accurate methods of testing this form of engine, but we believe that the simple locomotive would derive sufficient benefits from laboratory tests to return a good profit on the cost incurred. When establishments of this character get into proper working order, many of the unsettled problems connected with locomotive operating will have light thrown upon them. Others that are little thought of will be discovered and remedies applied to defects that want of knowledge has made very expensive. We anticipate that some of the most valuable work done by testing laboratories will be on old worn-down locomotives that are known on the road as scrap heaps.

It would be very edifying and instructive to know exactly how much useful effort is lost in a locomotive that has the tires worn so much that they are all of different size. The figures would probably appall the men responsible for operating expenses, and would be the means of sending many engines to the back shop that otherwise would have remained for months on the road, tearing the rail heads off, and wasting steam by internal friction. Disorders of valve-gear and of pistons that are endured because the cost is not counted, would probably be quickly cured if the exact resulting loss were known. There are scarcely any proportions of the locomotive that are positively settled as being productive of the best performance for different conditions. Even the size of an engine best suited for certain trains is a matter settled by personal preference, which is frequently against the interests of the company. Of late years there has been a tendency toward larger engines. The policy followed is, design the engine large enough and then add about 20 per cent. to its capacity. Accurate tests would demonstrate that running locomotives too large for the work to be done, is one of the most expensive fallacies of the day. But these details merely begin to tell about the work that could be done to improve locomotives, were exact facts obtained as to the effect of disorders which are scarcely suspected to be serious blemishes.

Parts Which the Owners of Cars Ought to be Responsible For.

To judge from the discussions concerning changes necessary in the Rules of Interchange of Cars that have been going on lately, there is a desire that changes should be made holding the owners of cars responsible for oil-box lids, M. C. B. coupler knuckles, and air-hose burst or worn out. We consider that the changes mentioned would be entirely equitable. The change would be highly seasonable at this time because there is a strong tendency on the part of certain roads to purchase the cheapest kind of appliances for rolling stock. Knuckles that are of inferior material are much more liable to break than those that are first-class. In addition to this there are certain knuckles that are peculiarly susceptible to breakage owing to weak forms. Railroad companies handling foreign cars ought not to be held responsible for the breakage of such knuckles. Similar reasoning applies to the loss of oil-box lids. Some box-lids are of bad shape and secured poorly. They are not designed properly, and therefore the owners ought to bear the expense of replacing them when lost. The cheapening process has exerted in many quarters a bad influence on the character of the hose used for air-brakes. There would be no injustice inflicted in holding the owners responsible for replacing all defective hose.

Amending the Rules of Interchange of Cars.

The various railroad clubs have lately been discussing the desirability of making various amendments to the rules of interchange of cars, with a view to reporting recommendations to the Master Car Builders' Association, for the purpose of discussing the proposed changes at the approaching convention. Not being the car representative of any railroad, we suppose it will be considered gratuitous for us to recommend a general amendment to the rules. We will, however, venture to make it in a sort of free-lance fashion. Our amendment is that the parties subscribing to the rules try to live up to them. If this advice were followed, it would be the greatest reform carried out since the fashion of making rules for the interchange of cars was introduced. We believe that on the whole, the interchange rules patched, altered, squabbled over and amended at every meeting of the Master Car Builders' convention have been beneficial to railroads, because some officials would feel in duty bound to adhere, in a fashion, more or less conscientious, to the rules they have helped to establish. But this duty has rested with astonishing levity upon the shoulders and consciences of most of the members of the Master Car Builders' Association. The common practice has been to strive by might and main in the conventions for the establishment of certain rules, and then go home and pay no more attention to them.

In looking at the disputes which arise over the interchange rules, we find that those who have taken the most active part in establishing certain tenets of the rules have been the readiest to do things which led to appeals to the Arbitration Committee. What strikes an outsider, looking at these disputes from an equity standpoint, is the utter absence of fairness on the part of the officials who struggle to get the best of interchanging roads. With this impression strong upon us, we would suggest that the members of the association form themselves into a conscientious Committee of the Whole, and direct impassioned appeals toward a general reformation. The most impressive text would be, "Study the rules and adhere to them." The most radical changes are generally recommended by men who have never studied or tried to obey existing rules.

BOOK NOTICES.

LOCOMOTIVE MECHANISM AND ENGINEERING. By H. C. Reagan, Jr. John Wiley & Sons, New York. Price $2.

The ground covered by this work has been gone over in many different forms in the past. The author, a practical locomotive engineer, has put a new dress on the subject, and one that can be readily understood by the new beginner in locomotive service. Commencing with the boiler, a description of the locomotive has been divided into parts, and without technical language, a clear description of the part is given. Following, and while the description is fresh in the mind of the reader, a catechism is given that relates to the management of it. The same rule is followed in relation to the supplementary parts of the locomotive, such as injectors, oil-cups, etc. The clearness in which the work is written should make it a good elementary book for beginners in locomotive service in the shop or on the road.

HEAT AND STEAM. By Charles H. Benjamin. Charles H. Holmes, Cleveland, Ohio.

This is a very compact little book, treating with various measurements of heat in an interesting fashion. It comprises chapters on heat, combustion and fire, chimneys, thermo-dynamics and steam. It contains nothing of a novel character, but the subjects are treated in very compact shape, and several very useful tables are given relating to steam, character of coal, etc.

ART OF COPPERSMITHING. By John Fuller, Sr. David Williams, New York. Price $3.

This is a profusely illustrated, practical book on the art of coppersmithing, which will be found of great service to workmen engaged in this art. It is essentially a book of instruction, and covers a large field. It is written in a very simple and comprehensive manner, suitable to the requirements of people engaged in this trade.

The American Institute of Electrical Engineers has issued the tenth volume of the report of that institution. The report makes a handsome volume of 719 pages, and embodies all the transactions of the Institution for the year 1893. The reports of the committees on the several subjects allotted to them, the papers read, and the discussions on them are particularly interesting in this volume, and in this age of electricity, not only to the electrical engineer but to the mechanical engineer and the many interested in electrical matters. In addition to the report of committees and papers read, an appendix to the present volume gives a summary of the units, terms, symbols and definitions of terms, electrical congress, extracts from the recent report of the British Board of Trade, committee on electrical standard, etc. The article on steam and water power will make the volume of particular interest to mechanical engineers, but taken as a whole, the volume is one that should be on the shelves of every engineer and electrical student. The report is published by the Institute at its office, 12 West Thirty-fourth street, New York City.

PERSONAL.

Mr. H. L. Bucklen, proprietor and builder of the Elkhart & Western, has taken charge of the operation of the road.

Mr. N. B. Lyons has accepted the agency for the Vulcan Iron Works, Wilkesbarre, Pa. He has moved his office to 56 Liberty street, New York.

Mr. Geo. O. Manchester, formerly of the A. T. & S. F. R. R. Co., has been elected vice-president and treasurer of the Sargent Co., Chicago.

Mr. H. F. Parke has been appointed superintendent of car service of the Fort Worth & Denver City, with headquarters at Fort Worth, Tex.

Mr. William B. Page, road foreman of engines has been appointed assistant master mechanic of the Pennsylvania Railroad shops at Jersey City.

Mr. B. W. Folger, formerly superintendent, has been appointed general manager of the Kingston & Pembroke, with headquarters at Kingston, Can.

Mr. G. Davis division roadmaster of the Burlington, Cedar Rapids & Northern, has been appointed division engineer, with headquarters at Cedar Rapids, Ia.

Mr. C. H. Chappell, general manager of the Chicago & Alton, was on April 2d also chosen vice-president of the road, to succeed Mr. J. C. McMullin, resigned.

Mr. F. Hackworth Young, who has been for some months in charge of the water service of the Mexican Central, has accepted a position with the Central Pacific.

Mr. William Byrd Page has been promoted from road foreman of engines, to be assistant master mechanic of the Jersey City division of the Pennsylvania Railroad.

Mr. W. H. Taylor, formerly of the engineering department of the N. Y. S. & W., is now master mechanic of the Wilkesbarre & Eastern R. R., located at Stroudsburg, Pa.

Mr. Ross Mackenzie, formerly assistant superintendent of the Eastern division of the Canadian Pacific, has been appointed general manager of the Niagara Falls Electric road.

Mr. A. T. Dice, formerly superintendent of signals on the New York Central, has accepted the position of superintendent of the Atlantic City Railroad, with headquarters at Atlantic City, N. J.

A notice from Superintendent of Motive Power Hickey, of the Northern Pacific, intimates that the jurisdiction of Mr. J. E. Phelan, master mechanic, has been extended over the Missouri division.

Mr. R. O. Cumback, formerly general foreman of the Illinois Central R. R., at Amboy, Ill., has been transferred from that place to the Clinton shops of the same road, and will continue to hold the same position.

Mr. F. T. Hatch, engineer of maintenance of way of the Pittsburgh division of the Pennsylvania lines, has been appointed superintendent of the Michigan division of the Vandalia line, to succeed Mr. N. K. Elliott, promoted.

Mr. George Collins has been appointed general superintendent of the Central Ontario, with headquarters at Trenton, Ont., to succeed Mr. J. D. Riddell, resigned. Mr. Collins has heretofore been secretary and treasurer of the road.

Mr. W. E. Looney has resigned as master car builder of the Louisville, Evansville & St. Louis, and that office has been abolished. Mr. J. K. Lape, superintendent of motive power, will have charge of the motive power and car departments.

Mr. C. M. Mendenhall, who has been for several years assistant master mechanic of the Meadow shops, of the Pennsylvania Railroad, near Jersey City, has been promoted to be assistant superintendent of motive power, at Jersey City.

Mr. Jas. McNaughton, superintendent of motive power of the Wisconsin Central, has had his jurisdiction extended over the car department. The headquarters of the car department have been moved from Stevens Point to Waukesha, Wis.

Mr. J. M. Egan, the well-known president of the Chicago Great Western, has resigned. It is understood that the cause of his resignation is due to a difference of opinion with the directors in regard to the best policy for operating the road.

Mr. John Mackenzie, superintendent of motive power of the Nickel Plate, has been visiting in California and making a tour of the Western country, where he did some of his most exciting work as a railroad officer when the transcontinental lines were being organized.

Mr. John J. Bingley, who has been for the last eight years with the Eames Vacuum Brake Co., of Watertown, N. Y., has resigned and removed to Hanover, Pa., where he previously had his home. Mr. Bingley has had thirty years' experience in the mechanical department of railroads.

Mr. W. H. Parsons has been promoted to be road foreman of engines of the Long Island Railroad. Mr. Parsons has been a good friend of LOCOMOTIVE ENGINEERING. One of his associates, writing about Mr. Parsons, speaks very highly of the appointment, and anticipates a bright career for him.

Mr. J. H. Moore, general foreman of the Erie shops, at Elmira, N. Y., has been promoted to be master mechanic of the Buffalo shops, succeeding Mr. Jas. P. Hubbard, deceased. This is another step in the policy introduced by the Erie people, of making all promotions from their own staff.

One of our correspondents is anxious to learn the whereabouts of Thomas D. Simpson, an old master mechanic, who left the Michigan Southern to go to Cuba. If any of our readers in Cuba or elsewhere know if Mr. Simpson is still alive, and where he is located, they would confer a kindness by sending particulars to this office.

Mr. S. W. McMunn, the well-known railroad supply man has been appointed sales agent for the Otis Steel Company, with headquarters at Chicago. Mr. McMunn is one of the best known representatives of railroad supplies. He was for years with the American Brake Company, and for the last six years has represented Carnegie, Phipps & Co., of Pittsburgh.

The necessity for reducing expenses has induced the Illinois Central people to close their machine shops at Amboy, Ill., and extend the jurisdiction of master mechanics to reduce the personnel. This has crowded out Mr. J. N. Sanborn, master mechanic at Clinton, Ill., and Mr. J. S. Chambers takes his place. Mr. E. O. Dana, master mechanic at Freeport, has received charge of the mechanical department of the Amboy division.

Mr. C. A. Hammond has accepted the position of eastern manager of the National Switch and Signal Company, with headquarters at New York. Mr. Hammond was for years superintendent of the Boston, Revere Beach & Lynn Railroad, and made a most enviable record for his close management. He has for years made the theory and practice of signaling a special study, and is regarded as authority on the subject. He is secretary of the Superintendents' Association.

One of the funny spectacles of last month was the alleged portraits of the leading members of the Central Railroad Club, which appeared in a Buffalo paper. President Waitt is the leading figure, and is standing up like a reformed pugilist, ready to fall back upon his former practices. Secretary Spear is seen calling the roll, and looking as if he had just swallowed the minutes and that they had not agreed with him. Fred. Griffith is represented pushing an enormous cigar into the neck of Mr. A. E. Mitchell, who does not seem to enjoy the operation. Vice-President Higgins and Mr. E. D. Bronner are looking fiercely at each other with no reason assigned why the relations should not seem cordial. We identify the personages in the same way that a juvenile artist indicated the character of his work, by saying "this is a horse," when others might have thought it was meant for a cow. If the names had not been appended, we never should have recognized our old friends.

Less than a month ago the writer spent a very pleasant hour with Mr. E. B. Wall, assistant general manger of the Western Pennsylvania lines. Mr. Wall seemed as bright, cheerful and in as good health as we had ever seen him, and it was a great shock a week afterward to learn that he was dead. He died from the result of the shock following an operation for appendicitis. Mr. Wall was a graduate of Stevens Institute of Technology, at Hoboken. On leaving the school he went as an apprentice to the Pennsylvania shops at Altoona, Pa., and remained there four years. He was then appointed chief draughtsman of the Pittsburgh, Cincinnati & St. Louis, and a year afterward was appointed to be assistant superintendent of motive power of the same road. He displayed so much ability in this position, that a few months afterward he was made superintendent of motive power. This position he held for about ten years. Before the opening of the World's Fair, last year, he was appointed assistant to the president, to look after the unusually heavy train service. About the beginning of this year he was made assistant general manager, with supervision over the purchasing department. Mr. Wall was particularly familiar to mechanical railroad men, owing to the struggle which he carried on in the Master Car Builders' Convention for years, to promote the Pennsylvania ideas, particularly the adoption of the Janney type of coupler. When the Master Car Builders' Association put itself on record as favoring a vertical plane coupler, it was due principally to the masterly efforts of Mr. Wall, who pushed through the resolution in spite of a majority of the convention being against him. We do not think that any young railroad man of the present day had such a bright prospect as that enjoyed by Mr. Wall, and it seems very sad that he should be cut off in the prime of life and in the portals of his career. He was the kind of man who made friends everywhere, and his premature death will cause widespread regret.

The officers of the American Railway Association elected for the ensuing year are: President, H. S. Haines, first vice-president, E. B. Thomas; second vice-president, W. F. Merrill. For members of the executive committee: C. W. Bradley, G. W. Stevens.

A rather ingenious improvement on angle-cocks has been devised by William Ogan, of Dayton, O. He bores about ten ⅛th holes around the top of the cock and then drills another, about $\frac{3}{16}$ths, down through the top so as to intersect all the others. This long hole is tapped and a small pet cock put in. When the handle is turned, however slightly, the air escapes through the holes to the pet cock and thence to the atmosphere, setting the brakes. To prevent setting the brakes on the angle-cock of the last car, the pet cock is kept closed.

Notice.

The three Educational Charts go with subscriptions for 1894. Any old subscriber renewing to the end of year or more will be entitled to them all. New subscribers must commence their subscriptions not later than March. Club raisers will govern themselves accordingly.

SINCLAIR & HILL.

Fast Run with a Ten-wheel Engine.

Nearly all the notable fast running done in this country of late years has been with eight-wheel engines, but a brilliant exception to this rule happened last month in a very fast run made by the Vanderbilt party passing over the Lake Shore road. The engine was a ten-wheel Brooks, of the kind employed on that road for heavy fast passenger service.

The run from Cleveland to Erie, a distance of 95½ miles was made in 95 minutes, including a 4-minute stop at Ashtabula for water, making the total running time for the 95½ miles 91 minutes. The next was an 88 miles run, which was made in 82 minutes, including another 4-minute stop. The remainder of the trip to Buffalo was made at about the rate of 70 miles an hour.

The Chicago, Rock Island & Pacific have made arrangements to put the McNaughton fire kindler into thirteen of their roundhouses. The Burlington, Cedar Rapids & Northern are putting it into their principal roundhouse at Cedar Rapids.

The engineering department of Cornell University have placed an order with Mr. A. L. Donnell, the artist, who made the drawing of our Chart No. 2, for one to be drawn sixteen times the size of our plate. This will be used for educational purposes in Sibley College. The picture has excited great admiration in all quarters, and thousands of them are framed and set up in railroad offices for the purpose of reference.

The management of the Rock Island road appear to consider it a good thing to encourage their trainmen to do all in their power to prevent robberies. In pursuance of this policy, they called Engineer J. D. McKinney, to Chicago, last month, and presented him with a handsome gold watch and chain, as a token of their appreciation of his bravery in preventing a robbery of his train near St. Joseph, Mo., in last March.

The Fitchburg Railroad Company have arranged to provide transportation to the Saratoga conventions for all members and their families who find it convenient to travel by that road. Colonel Ewing, the general superintendent, has displayed a warm interest in providing all conveniences for members going to the conventions, and Mr. J. W. Marden, superintendent of the car department, and Mr. John Medway, superintendent of motive power, are both doing all they can for the accommodation of the members.

Three railroad men were at New Orleans attending the last Mardi Gras, and they went into a hotel for dinner. A waiter who came to serve the party was a Mexican, and he made bad blunders in his English, and Col. Meehan began speaking to him in Spanish. The Colonel had spent several years in Cuba and speaks Spanish like a native. The waiter was emotional in his pleasure at finding a man to speak to in his own tongue, and the others looked on in amused admiration. After they talked for some time, filling the air with the rattling R's, Mr. Carroll exclaimed: "Well! well! I never knew before that Meehan could talk Irish in that style. Why, Jim, you ought to go over and make speeches to the Home Rulers in their own language."

EQUIPMENT NOTES.

The Florida Southern have ordered three passenger engines from Brooks.

The Savannah, Florida & Western are reported in the market for ten first-class coaches.

All of the 300 cars built by the Laconia Car Co. for the Fitchburg road have been delivered excepting five.

A full complement of twist drills and ... has been supplied to the United States cruiser *Columbia*, by the Cleveland Twist Drill Co.

The Berwick Car Co. are building for the D. S. & S. road ten special cars for heavy coal traffic. These cars are built under a special specification.

A correspondent in Buda, Ill., claims that a plumb-bob recently described in these pages by John Bourne, Kan., was invented by Mr. Sam Barrett, one of the pioneer railroad men of this country.

Hilles & Jones Company, Wilmington, Del., have sent out a neat illustrated catalogue, showing their punches and dies. The principal tools are shown in half-tone engravings and the punches by wood-cuts.

A rather ingenious switch-rod has been patented by Mr. John Wolter, yard-master of the Pittsburgh & Lake Erie, at Youngstown, O. The rod has a turnbuckle in the middle, which makes adjustment very easy.

We learn from the Leach Sanding Apparatus people that they have lately applied their sanding device to seven new roads, and that they are putting it on at the rate of about thirty sets a month. Those who are using the device speak very highly about its efficiency.

The Wisconsin Central are prepared to fit up three entire trains with vestibules and electric lights. The intention is to use them on the limited between Chicago & St. Paul. A novelty in connection with these trains is that the vestibules will be applied to the tenders of the engines.

The Joseph Dixon Crucible Company, Jersey City, N. J., have lately issued an exceeding interesting pamphlet on the subject of graphite for lubrication, in which they have embodied a generous amount of scientific and practical information. This pamphlet may be had for the asking by all who are interested in the matter of improvements in lubrication.

There was a convention of the Railway Air-Brake Men's Association held at Columbus, O., last month. President Farmer presided and a very profitable convention was held. A notable feature about the discussions on air-brake matters was their practical character, all those taking part manifesting a desire to impart to all concerned a more accurate knowledge of the mechanism and proper way to handle air-brakes.

Rather a unique form of directing attention to the National Switch and Signal Company's equipment has been tried by Mr. Charles Hansel, western manager for the company, with office in Monadnock Building, Chicago. He sends out an annual free pass closely imitating the railroad annual. This pass is between danger station and safety station, and the holder is politely invited to visit Mr. Hansel's office, to see how it is done.

A new concern, the Detroit Twist Drill Company, was organized on April 9, 1894, with four stockholders, who are the directors of the company. William Reid, president; Harry S. Hodge, vice-president; Charles M. Swift, director; N. G. Williams, Jr., secretary, treasurer and general manager. Mr. Henry F. Hiller continues as general superintendent, and the concern will be represented among the trade by Donald Churchill. They have increased facilities for turning out all kinds of drills and kindred tools.

From a Pittsburgh paper we learn that the Tyler Tube Works, of Washington, Pa., have purchased additional land for the purpose of extending the works. Notwithstanding the hard times, the Tyler Tube Works have not closed down, or very greatly reduced their output. It is said to be the only plant of the kind in the country which has been in steady operation during the past year. It is running one turn in the tube mill, and double turn in the rolling mill at present, giving employment to 340 men.

We have recently received several catalogues from parties in the railway supply business which are not made according to the standard sizes adopted by the Master Car Builders' and Master Mechanics' Associations. We would like to suggest to parties making catalogues that they would serve their own interests by adhering to the standard sizes, because most of the heads of the mechanical departments are getting cases made to hold standard sizes of catalogues, and those that do not conform to these sizes are likely to find their way into the waste basket.

The Maine Central Railroad is known to be one of the best managed properties in this country, and it is noted for the fine condition of its rolling-stock. After the annual inspection last year, the Railroad Commissioners reported that the rolling stock of the Maine Central is in all respects first-class. None better can be found on any road, nor any kept in better condition. Large additions of the best to be procured, have been made in motive power and in cars during the year. The station buildings are models of design, comfort, convenience and general appearance.

In the course of a letter from Mr. E. C. Spaulding, general manager of the Southern Iron Car Line, he says that the iron car has been generally condemned on account of the trouble which roads have experienced in ordering castings, and the delay to the cars until these castings were received. The mechanics did not have the time to analyze the trouble and see just what part of the car was faulty. From records covering four years, we find that 93 per cent. of all the castings ordered were required for repairs to our draft rigging. We have overcome this source of weakness by the application of a heavy wooden subsill under our cars, between the bolsters.

The Michigan Central Railroad Co. have been using a system of car heating which the Consolidated Car Heating Co. claimed to be an infringement of their patents. The railroad company contended this claim and the case went into court and was decided last month against the railroad company. We have been insisting for some time that many railroad companies act very unfairly towards patentees of the appliances they put into use. Many of them are using patented articles under the impression that the owners will not go to the great expense of upholding their rights in the courts. This decision against the Michigan Central Co. is a vindication of justice and ought to be a lesson to many others.

Shortly after the Morris box lid was put on the market, a number of manufacturers and railroad companies began appropriating it without troubling themselves to pay royalty. The lid is very simple, durable and efficient, and naturally its good features appeal to that class of men who like to obtain things for nothing, and the other class who have a tendency to take possession of their neighbors' goods. Unfortunately railroad rolling stock bears very strong traces of this unscrupulous way of doing business by different companies and manufacturers. The Morris Box Lid people bore the infliction for a few years, but at last they have turned, and have entered suits against the Drexel Railway Supply Co., of Chicago, Pennock Bros., of Cleveland, and others.

At the last meeting of the American Railway Association, a committee on train rules reported in favor of making quite a number of changes in the code of train rules, which was adopted about five years ago. The changes recommended were framed with the view of making the rules more intelligible, and less open to misconstruction. When they came up for discussion, decided opposition was manifested towards making any changes. There appeared to be a hope and belief that no change should be made on established rules, unless the call for it was decidedly urgent. It was considered a good plan to let the members consider for six months the proposed changes, and then if they considered that changes were desirable they could take action to that effect.

In a report submitted to the American Railway Association it was shown that 236,814 freight cars have already been fitted up with air-brakes, and that there are yet 776,724 yet to be fitted. There are 282,983 cars fitted with automatic couplers and 730,555 yet to be fitted. There are 25,212 locomotives equipped with power-brakes, and 5,016 that are not so fitted. This represents cars and locomotives belonging to roads that are members of the American Railway Association. This shows that the application of power-brakes to locomotives has been exceedingly rapid within the last few years. The application of brakes and automatic couplers to freight cars proceeds very slowly, but nothing else could be expected at present with the small earnings that most of railroad companies report.

On the Long Island Railroad they have a good many cast steel driving-wheels which are in high favor and are likely to be steadily increased as the cast iron centers of other engines break and call for renewal. A rather curious thing in friction was discovered by the use of these driving-wheels. The driving axle-boxes of many of the engines are weak, being rather small, and steel was tried on account of its superior strength. As usual when steel driving-boxes are introduced, there was immediately trouble from the boxes, cutting the wheel hubs, and brass liners had to be introduced. It is found, however, that cast steel wheel centers will run with cast-iron boxes without any more wear than there is when wheel-center and box are both cast iron. It is strange that the steel and iron rubbing together will cut in one case and not in the other.

At a meeting of the Railway Associations, held in New York City last month, President Haines in his opening address devoted himself to the question of How shall operating expenses be reduced? At least that was the subject of the address, but the real question discussed was, When will rate cutting cease? He holds that human ingenuity has done its utmost to give cheap transportation by rail, and that very little more can be done in the way of reducing operating expenses. He made some very plain talk about the railroad officers who are always ready to cut rates to obtain business. He spoke of the readiness to reduce rates already ruinously low, and expressed the belief that the time has arrived in the development of this country's resources and of its railroad system, when such a policy in the management of competitive traffic cannot be persisted in without disastrous consequences.

We are informed by a correspondent in Montana that the Butte, Anaconda & Pacific, which was built by the great Northern Railway Co., is already doing a flourishing business. The main line is twenty-six miles long and parallels the Montana Union for twelve miles, and then proceeds on much better grades than the latter road. In the way of motive power the road has started out with one 8-wheel, three moguls and five switching engines, all built at Brooks'. They are using Rodger ballast cars for hauling the raw ore and they answer this purpose very well. The company have built a ten-stall roundhouse at Butte, also coal sheds, sand-house, water-tanks, etc., and it is expected that they will build machine shops in the early spring. The leading officers of the road are Mr. M. Donahue, general manager; Mr. George F. Copeland, superintendent; Mr. George Henderson, master mechanic. It is reported that Mr. Copeland is about to resign.

Accepting the Teaching of Reports.

A very good suggestion was made by Mr. G. W. Rhodes, of the C., B. & Q., in some remarks he made on a paper which had been read before the Western Railway Club. He said: "The important question is, 'How are we to derive the greatest benefit from the paper?' My idea is that as many of the members as can ought to get copies and present them to their master mechanics, and the suggestion made, Do not try to read it all at once. Take it, part by part, and read it three or four times, and then if you get it thoroughly mastered, put some of its teachings into practice."

This is a line of instruction greatly needed concerning all the reports and discussions that take place at all our clubs and conventions. The records of experience, the confessions of mistakes, and the logic of experiments ought to carry valuable lessons, but in nearly all instances they merely excite a passing interest and are quickly forgotten. In carefully watching the field of results we have been forced to the conclusion that no seed produces such a sterile harvest as the proceedings of clubs and conventions. The sentiment that the information brought out at technical meetings is intended for practical application needs to be industriously preached. Men who attend these meetings or read the proceedings have often a better way pointed out than the path they are following, but somehow they vaguely conclude that the better path is intended for some one else. A little self-examination would often show them that no one needs the new way so much as themselves.

Wabash passenger engineers have been cut from $3.50 to $3.15 per hundred miles, through freight engineers, from $4 to $3.60, local freight engineers, from $5 to $4 per day, local freight firemen, from $2.75 to $2.25, passenger firemen, to $1.75 per one hundred miles, and freight firemen to $2 per one hundred miles. Conductors are cut in the same proportion.

We have at hand the fifth statistical report of the Interstate Commissioners on the Railroads of the United States. The information given and form used is the same as in previous reports, and needs no words of commendation at this time. Statistics are useful rather than entertaining reading, but to the railway man the reports are both when presented in the clear and comprehensive form that they have been by the compiler of this work.

The latest theme of talk among engineers in Chicago is the passing the Engineers' Examining Board of the city by a young woman named De Barr, who has received a certificate of competency as an engineer. As a mild suggestion we would remark that skirts are not safe articles to wear among machinery. We have no doubt, however, that a young woman who has prepared herself to pass an examination as an engineer is equal to the sacrifice of abandoning flowing garments.

A Bit of Railroad Geometry.

BY JOHN H. COOPER.

A few years ago there appeared in a Chicago newspaper a question in effect like this If a point be taken on the tread of a 5-foot locomotive driving-wheel, what distance will that point travel through the air in going from Chicago to Milwaukee, supposing the distance between the two places named to be eighty-five miles?

I took some pains in replying to this, furnishing extended mathematical detail, and sent the same ahead by post. To this I received reply that they didn't care anything about the facts of the case; it was simply an "ad." to call public attention particularly to their road and that it had the effect intended.

The effort brought out quite an array of geometrical data, which I believe will pay to reproduce and reconstruct for your readers, first promising that I will make the whole matter so plain that he who runs may read and understand.

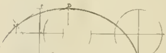


Fig. 1

I will, therefore, without further preliminaries, proceed to lay down the lines of it, explaining in simple language the purpose and value of each.

If a circle roll along a straight line, a point on the circumference of this circle describes a curve, which is called a cycloid (a Greek word which means *circlelike*).

This curve is one of the most interesting we know, in respect both of its geometrical properties and of its application in mechanics.

In Fig. 1 we have shown such a curve, as well as the simplest, because most practical, way of producing it. If the curve desired is to be of a certain height, say $C D$, then we must take a circle plane of any convenient material at hand having a diameter equal to $C D$.

To this circle plane a point or pencil must be placed at its edge, say at B, and locate the same on the straight surface $A B$. If now we roll this circle upon $A B$

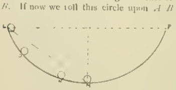


Fig. 2.

from B to A without allowing its circumference to slip the point will describe a curve shown by $B D A$.

The terminal A, making the completion of the curve will also make the line $A B$ in length equal to the circumference of the circle which rolled over it The height and middle of the cycloid will necessarily be at D.

This curve $B D A$ marks the path and distance traveled by the point on the locomotive wheel noted in the question, while the line $A B$ marks the path and distance made by the driving-wheel and the train for every revolution of the driving-wheel. Now, to obtain the distance traveled by each, the case is very plain for the wheel and train, as with a 5-foot driver, each revolution moves the wheel and train 15.7 ft., which is the circumference of the wheel (providing it don't slip, an infirmity to which it is liable). But how is it with the point on the tread of the wheel? What distance does it travel through the air while the wheel makes one turn?

Here is where the work of the geometer comes in. The length of the cycloid is found to be exactly *four* times the diameter of the circle that describes it, in this case it will be 20 ft.

Now, we have the two units of measure by which the question can be answered—when the train travels $15\frac{7}{10}$ feet the spot on the driver travels 20 feet, and with the knowledge of this property of the cycloid other examples, including other diameters of wheels and road distances may be easily solved.

One of the most interesting properties of this curve is, the time required for a body to descend from rest from any point, as L, O, or N, Fig. 2, in the arc of an inverted cycloid, to the lowest point of the curve at M, is *the same* from whatever point of the curve the body begins to descend. This property is sometimes expressed by saying that the cycloid is the *isochronal* curve, or the curve of equal time, and for this reason efforts have been made to cause the pendulum bob of a clock to move in a cycloidal path in order to vibrate in equal time whatever be the extent of the arc through which it moves.

Another property, the sequence of this is the body having reached the lowest point, will, through the impetus received in the fall, ascend the opposite branch of

Narrow-Gauge Passenger Car, Built by Barney Mfg. Co.

the curve towards P, to a height equal to that from which it fell losing velocity in its ascent by the same degrees as those by which it acquired it in its descent, and it will employ precisely the same time ascending as it did in descending.

It is very clear now, accepting these facts as true, that if a surface could be procured that would be perfectly smooth and hard, the cycloid would thus present a means for the solution of the perpetual motion problem.

Another peculiar property is, that a body—a ball, for instance—will run from L to M, down the cycloid in less time than it will reach M by running the straight line $L M$. This does not seem possible, because we are used to believing that a straight line is the shortest distance between two points, and is therefore the way to reach a distant point in least time. For this reason the cycloid is called the curve of *quickest descent*.

Now, as these properties are sometimes true when considered in reverse order, we may also call the cycloid the curve of *easiest ascent*. Suppose we wish to deliver water at L in a vertical direction from a lower level, say at M, in a horizontal direction. The path of a cycloid is the curve and direction we should run our pipes to secure this advantage.

The area enclosed by the cycloid $A D B$ and its base $B A$ is equal to three times the area of the generating circle $D C$. If you wish to prove this statement in a practical way, do as Galileo did, who discovered this curve in the year 1615.

Take sheet metal of uniform thickness, cut out truly the generating circle, strike a cycloid with it, and then cut that out truly; weigh each, and you will find them 3 to 1, which solves the question of areas

Now, having a cycloidal plate, divide the axis of the curve $C D$, Fig. 1, into eight equal parts; at the third part from C make a center and poise the plate on that point: it will balance and this is the location of its center of gravity.

Now, let us take any position of the generating circle, say $E H F$, Fig. 1, and draw the line $E H$ from the points of contact E in the base and H in the curve, and then through H draw $H F$ at right angles to $H E$; this line $H F$ is a tangent to the curve; it would be perpendicular to $A B$ at A, and parallel to $A B$ at D. This property gives value to the teeth of cog-wheels which are formed on the so-called epi-cycloidal principle. Furthermore, the line $A E$ is equal to the arc $H E$, plainly because the circle rolled that far to make it.

In hydraulic work the cycloid plays a most important part in the mouth-pieces of the suction and delivery pipes of pumps

If water is to be received and delivered into pipes beneath the surface of water, these terminals of the pumping main should be formed trumpet-shaped, the curve of which should be a cycloid, if the least resistance to the flow of the water to and from them is desired.

This curve was applied to the surrounding rings, called *diffusers*, which were used by Mr. Boyden upon his turbine wheels at Lowell, Mass., several years ago, by which great gain in the utilization of the water power was realized. Hoping now you have seen several marvelous things brought out by the rolling of a circle on a straight line, I will end up with a story, the truth of which is vouched for in reliable history. I wish, also, to prove that difficult things can be made easy and the way to learning can be shortened if any one is only bold enough to show how to do it. Query Did the Reading R R official who ordered clean shaven faces on its employés have in mind a great educational movement? But read further to find out how great minds run in like channels.

When Peter the Great determined to arouse his subjects to the active life and business habits of the people of England and Prussia, he began by removing impediments.

He wished his people to become skillful workmen and mechanics, and it was evident that the Russian of his time, with his long flowing robe and his pendulous beard, could not work at the forge or the bench

To remedy this, Peter stationed men at the city gates, each armed with a pair of shears, who cut off the long skirts and sacred beards of all those who passed through the city gates.

This was the first step in giving them a mechanical education, and the effect produced, in raising his people to the level of other European nations, has always been a subject of admiration.

A similar course was adopted later by the French, when the School Commissioners dismissed in a summary manner the teachers of the schools and colleges and flung after them, so to speak, all their traditional books and ancient methods of teaching, because a new era had arrived when practical knowledge had taken the place of speculative, and when it was of paramount importance that students should reach, by the shortest and plainest route, the wide range of learning now for the first time open to the human mind.

The object of mathematics is calculation, and while it is necessary to learn the definitions, yet many of them are more difficult than the things defined.

No wonder that the King asked of Euclid if there was no easier method than the elaborate systems then taught, which question brought out the famous reply "*There is, indeed, no royal road to geometry*"

This may have a double meaning; there is a *common-sense way*, in which the highly educated and the luxurious do not always travel—but that way is open to the earnest, practical mind.

Drop Pit on M., K. & T.—Directions for Using.

The useful drop pit shown on next page is in use in the Missouri, Kansas & Texas shops at Denison, Tex. For the drawings and description we are indebted to Mr. C. T. McElvaney, master mechanic of the shops, who wrote

I send you under separate cover blue print of a drop pit that we use here, and have gotten to feel that we cannot get along without. We put one in roundhouse about four years ago, and were so well pleased with it that we put one in the back shop and use it altogether, removing and applying wheels under engines.

An engine comes in for an overhauling, we put a force of four laborers under charge of a foreman, who take down rods and binders and remove wheels, they also put them under when fitted.

Have taken wheels out of a 19 x 24 mogul engine at a cost of $3 85, and had engine off of drop pit and placed on one of the other pits. For removing engine truck-wheels we find it indispensable; can remove and replace wheels in a mogul truck with ease in thirty-five minutes, and in a four-wheel truck in from forty-five to fifty minutes.

Have taken front pair of drivers from under a mogul in roundhouse, and had them in wheel lathe in back shop in one

... after engine came in roundhouse ... great advantage in removing truck ...heels, it saves a great deal of time and ... in not having to remove pilots. In ...ing out or putting in drivers it requires ...blocking to be lugged in or out, and en...ne is never off her proper height from ... It also saves taking a great many ... the fittings off the engine as is the case ... jacking up.

... tried to use compressed air at 200 ...nds but found it too quick and treach...ous, so now we use a No. 3 Knowles ...mp in roundhouse and a pump driven ... main shaft in back shop. In build... the pit, old bridge timbers can be used ...ead of stone if so desired.

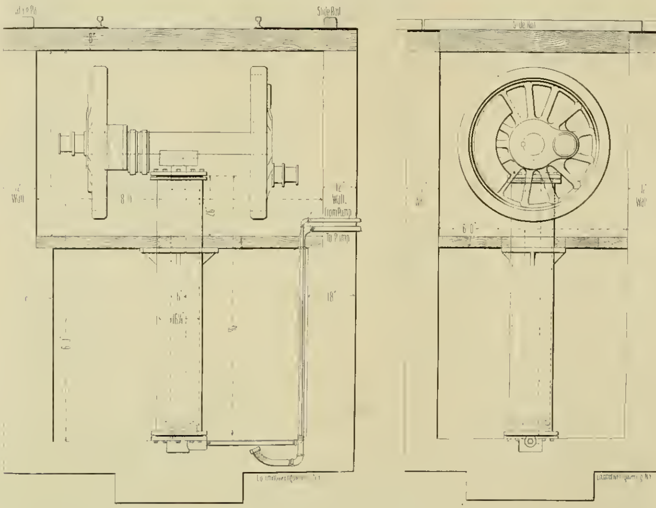
For the benefit of interested parties I ...nd directions for operating hydraulic ... pit.

TO MOVE DRIVING-WHEELS FROM 4-WHEEL CONNECTED ENGINE.

... back drivers over cylinder, run ...p to axle and lift engine until weight are removed, if it is desired to remove pony truck, drop a pair of engine truck wheels with boxes and brass on axle into pit, put up binders on front jaws, place over pit and shove up the engine truck wheels against binders and lift engine until blocks can be taken from over pony truck, lower engine on rail and pull back until pony truck is over pit, run ram up against pony truck axle and raise from rail, remove slide rail and lower truck into pit.

To remove truck wheels from a pony truck, place truck over pit, run ram up against truck axle, raise engine and block on front driving-boxes, chain truck frame to engine frame and lower wheels in pit, back engine off, take wheels out of pit and put new wheels in pit, run engine over pit and put wheels in truck, this operation is best done with steam on engine, and engine can handle herself.

If the entire truck is to be taken out, it can be done the same way. To remove a pair of wheels from a four-wheel truck, first put wheels to be applied down in pit



Drop Pit on the M., K. & T.

is off front drivers, block between driving-box and frame, slide out the movable rails on drop pit and lower back wheels into pit; push or pinch engine from over drop pit, raise wheels and move them out of the way, put up back binders, pull engine back until back jaws are over pit, roll a pair of engine-truck wheels with boxes and brass under binders, run up ram and lift truck wheels against binders, raise engine and remove blocking from front driving-box, lower ram and pull engine back until front wheels are over pit, run ram up and lift wheels from rail, slide out rail and lower wheels in pit, replace slide rail and put engine on pit that is desired to overhaul engine on.

For six or more connected the operation is the same as the foregoing except front drivers, which is as follows. Place front drivers over pit, raise engine up and block on top of pony truck between engine frame and truck frame, remove slide rail and drop drivers in pit, after all drivers and roll to one side, then place wheel to be removed over pit, run ram up to axle and raise truck two or three inches, shove a 12 x 12 timber across pit directly under center of trucks and block top of timber under truck springs; drop wheels to be removed in pit and roll to one side; place new wheels previously put in pit in V block of ram and raise to engine truck jaws, and lift engine truck frame until blocking under center of truck frame can be removed.

Proper Size of Stay-Bolts.

Our contributor of the boiler construction article, C. E. Fourness, writes us:

I noticed a question in the March number as to the proper size of stay-bolts to use for a locomotive boiler, carrying 180 pounds of steam pressure.

According to the rules and regulations furnished to the government inspectors for the United States, the greatest distance apart that stay-bolts can be or are allowed to be spaced in a boiler sheet $\frac{7}{16}$-inch thick is 3⅞ inches, this gives a pressure on each stay-bolt of 2,710 pounds.

In my opinion, a ¾-inch stay-bolt is the smallest bolt that should be used, especially for pressures to exceed 80 pounds. This size of stay-bolt, 12-thread, will sustain a pressure of 2,881 pounds and not have a pressure to exceed 6,000 pounds per square inch upon the bolt; this you will readily see is the proper size of bolt.

The Water Per Horse-Power of the Indicator Diagram.

One of the most important uses of the steam engine indicator is the finding out how much water is consumed for every horse-power developed. This decides whether or not an engine is working on a fair consumption of fuel. To figure the water by means of the diagram has generally been an operation which required tedious calculations, and on this account was generally left out by men giving records of indicator tests of locomotives. Lately there have been several short methods devised for ascertaining the water per horse-power represented in the diagram. Particulars of the easiest method we have seen were published by Mr. C. H. Quereau in his paper on "Steam Distribution for High Speed Locomotives," read at the Western Railway Club. The process is as follows. A point on the expansion line just previous to exhaust opening is selected. The steam pressure for this point and the period in the stroke are readily determined. Say they are 51 pounds and 16 inches. If the engine is a 19-inch by 24-inch, and has 7 per cent. cylinder clearance, the volume of the cylinder at 16 inches of the stroke is 2.86 cubic feet. From the indicator card we know that, at 16 inches of the stroke, the cylinder was full of steam at a pressure of 51 pounds per square inch above atmospheric pressure. Our steam tables tell us that a cubic foot of steam at this pressure weighs .1585 pounds. Therefore, the 2.86 cubic feet of steam at 16 inches of the stroke weigh .45 pounds. In the same way the weight of steam saved in the cylinder during compression is determined at a point on the compression line just before lead opening. Say it is found to be .09 pounds, subtracting this from the amount found just before exhaust opening, we find that the cylinder from which the card was taken was using .36 pounds of steam, or water, per stroke. Multiplying this by two gives the water per revolution in one cylinder. Multiplying this by the number of revolutions per hour, and dividing by the horse-power generated, gives the indicated water per indicated horse-power per hour for one cylinder. This does not account for all the steam passing through the cylinder, as about 25 per cent. is in the shape of steam which has been condensed and is not shown by the indicator card, but the indicated water may be safely used within reasonable limits, as measuring the efficiency of a locomotive where average cards are compared, taken under like conditions.

Feeding the Boilers.

The following is contributed to us by Mr. H. L. Clark, Atchison, Kan.:

I claim that the fireman is the one who should pump the engine, and I will try to convince enginemen that I am right.

When leaving a station with the boiler full of water, and the engineer doing the pumping, a good fireman is always worried to know just when the engineer will put his injector on. The fireman does not want to waste any coal, and it takes very little coal to keep steam up, but the fire must be hot when the injector is started to hold the steam. It often happens that when the injector is started, the fire is in no condition to receive it and the steam soon drops back. To regain the steam, the fireman must crowd his fire, which often results in leaving a bank, and a waste of coal

If the fireman is indifferent as to how his coal record is, and only tries to keep the engine hot to be safe he will keep up a heavy fire, and then hold the door open or let the engine pop. As some engineers keep the boiler full all the time, this happens at every station, and in going over the division considerable coal is wasted.

But when the fireman does the pumping, then there is a great change; he becomes a better "boy" and takes more interest in his work. There is not so much to worry him. He can gradually work his fire into the proper condition, and when it is time to start the injector he has a hot fire to receive it, and has not wasted any coal.

The most successful firing I ever did was when the engineer allowed me to pump the engine on a local passenger train. The injector on my side would not quite supply the engine when working her hard, and the engineer would occasionally start his injector just before shutting off for a station and regain the water that was lost. But on level track the injector would just supply her, and it was a pleasure to fire the engine she steamed so well.

There is another thing about the saving of coal that is not given the attention it [illegible] by some engineers, and that is [illegible] getting out of town. To show the [illegible] that is practiced on the fireman and the company by some men, I will relate [illegible] that I will swear to.

I was once unfortunate enough to fire for a man who had a notorious habit of hogging an engine when leaving town. He would pull the throttle wide open, and when going about fifteen miles an hour he would pull the lever about half way up the quadrant and leave it there until the speed was too fast, and then hook her back and [illegible] easing her off on the throttle, [illegible] often going to the next town and [illegible] for time. This man took a lay-off, and the engineer who was put on in his [illegible] saved coal enough in a round trip to more than pay my wages, and in a run of [illegible] miles against a strong wind he made [illegible] minutes.

Building of the Cuyahoga Engines.

Mr A J Cole, of Los Angeles, Cal., a pioneer engineer, writes:

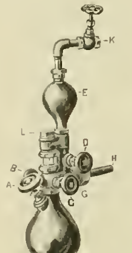
"I see in your February number an article from J. F. Holloway. I think I have a faint recollection of him. I do not know who this Billy Smith was to whom he alludes. I know Wm. F. Smith was master mechanic of the Cleveland, Columbus & Cincinnati Railroad, whether he had anything to do about designing the engine built at the Cuyahoga works or not, I do not know; I believe that he did. But this I do know, that Mr. Sterling wrote to Detroit for Mr. Thomas L. Simpson to come to Cleveland and build the locomotive, as there were none there who knew anything about the proportions of frames, boilers, or anything else. Mr. Rogers was foreman of the shops while building marine engines and such like work. T. L. Simpson was master mechanic of Michigan Central and had built some two or three locomotives while holding that position, and this was why Mr. Sterling wrote for him, and the same Holloway is very much mistaken about Mr. Rogers who did the drawings, for I am positive that Mr Simpson drew the plans of these 6-footers, also the 4 and 5-foot wheelers of the Cuyahoga build. I know this because I have seen the drawings at his house, and have seen him at work on them. As for Billy Smith, as he calls him, if he means Wm. F. Smith, I will say that Mr. T. L. Simpson had forgotten more than Wm. F. Smith ever knew. Mr. Hamilton ignored Mr. Simpson altogether, and I think I know his reason for so doing.

"The rest of Mr. Holloway's communication, as far as I know, is correct, except the cut-off arm. I am not positive whether this was Mr. Rogers' or not. I know that Mr Simpson was always advocating the [illegible] motion, and he and myself have had several adoes about it, but I have found long since that my conception of the link motion was all wrong. My idea was that the steam could be managed as well by the throttle as by links the way they were then made. Mr. Simpson contended that an arc for valve motion was the correct principle for cutting off steam, and I have since found him to be correct. I have the original lithograph of the "Reindeer," and money would hardly buy it from me. The frame alone cost me $16. Honor to whom honor is due."

A New Locomotive Lubricator.

We illustrate herewith a new form of locomotive lubricator that is just now attracting some attention on account of its simplicity and efficiency.

As will be seen, it is a single glass sight-feed instrument, one feed supplying both cylinder and chests; there is only one internal pipe, all passages and valves being in the body of the instrument itself. The oil reservoir is of the strongest possible form and contains nothing in the way of pipes, feed attachments or what-not; it is suspended below the frame of the instrument and its expansion and contraction can affect nothing. It is simply screwed into the frame, and has a filling plug and a drain cock tapped into it.



The condensing chamber is also globe-shaped and has no attachments except the steam pipe from the boiler, the equalizing tube standing up inside of it, but being attached to the frame piece only.

When the oil chamber is filled and steam turned into the condensing chamber, water accumulates in the same until it flows over into equalizing-tube 21. This fills passage 15, 14, and glass tube 13 at once, then when water-valve *B*, Fig. 5, is opened, enters the oil-chamber and displaces the oil, which rises to oil-valve *C*, where the drop-feed is regulated.

When the oil leaves the feed-nipple it rises through the water in the glass and flows over into the pocket or depression 16, where it is caught by a jet of live steam from the equalizing tube 21 and forced through the passage in suspension-stud to the cylinders in the form of an oily vapor—experiments proving that it reaches all parts of chests and cylinders in this condition.

In this oil passage 19, Fig. 1, there is a valve shows at 22 in Fig. 4 and at *H* in Fig. 5. This valve has a point on it to clean out passage and is used to restrict the opening until the pressure is equalized in the entire cup.

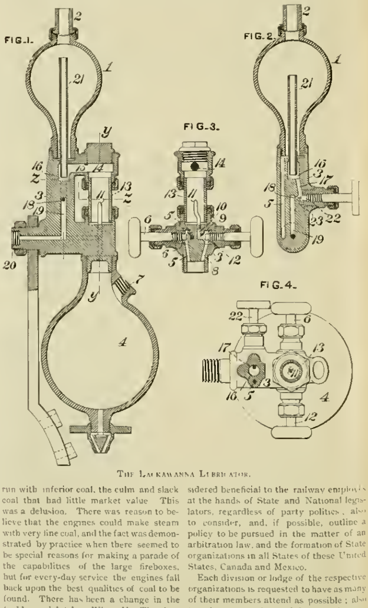
By closing this valve all operations of the cup are stopped, the glass tube is instantly filled with water, stops the feed and prevents oil from passing up the tube 21 to the condensing chamber. This latter fault is a grievous one with some lubricators, and is prevented in this one by simply dropping the lower end of tube 21 into the pocket 16, so that the end is sealed with water when valve 22 or *D* is closed, making a trap.

The sight-feed glass is very short and thick and is in plain view from all parts of the cab. It can be renewed by taking off the cap *L* and dropping in a new tube from the top.

The Lackawanna Lubricating Co., of Scranton, Pa., who make this instrument, have been experimenting for some years with lubricating cups and have over a hundred of these lubricators in successful use.

Large Saving on Coal Bills.

There has been a belief entertained among railroad men for years that the Wootten fireboxes used on the Philadelphia & Reading enabled the greater part of the locomotives on the road to be run with inferior coal, the culm and slack coal that had little market value. This was a delusion. There was reason to believe that the engines could make steam with very fine coal, and the fact was demonstrated by practice when there seemed to be special reasons for making a parade of the capabilities of the large fireboxes, but for every-day service the engines fall back upon the best qualities of coal to be found. There has been a change in the fuel burned lately. When Mr Theodore Voorhees took charge as vice-president he got looking over the fuel bills and was surprised to find the high quality of coal supplied to many of the engines. Having no interest in that particular type of engine beyond getting them to run at small cost for fuel, he naturally wanted to know why they did not burn the coal they were designed to burn. This was a very embarrassing line of inquiry and could not be answered satisfactorily. Peremptory orders were given to burn slack coal in every engine capable of making steam with it. On some of the divisions, where soft coal could be bought cheap, the freight engines were required to burn it. The result of these changes is that the company is saving about $100,000 a month on the coal bills.



THE LACKAWANNA LUBRICATOR.

Convention of Railroad Men.

There will be a great convention of the railroad employés of the United States, Canada and Mexico, held at the Lenox Lyceum, New York, commencing May 27th, under the auspices of the Order of Railway Conductors, and under the direction of New York Division 54 and Millard Division 104 of Railway Conductors.

The following organizations—Order of Railway Conductors of America, Brotherhood of Locomotive Engineers, Brotherhood of Locomotive Firemen, Brotherhood of Railway Trainmen, Order of Railway Telegraphers and a Switchmans' Mutual Aid Association—wherever existing, are invited to attend and participate in the deliberations of the convention.

The purpose of the convention is to consider, and, if possible, to agree upon a line of action to be followed in the direction of securing such legislation as may be considered beneficial to the railway employés at the hands of State and National legislators, regardless of party politics; also to consider, and, if possible, outline a policy to be pursued in the matter of an arbitration law, and the formation of State organizations in all States of these United States, Canada and Mexico.

Each division or lodge of the respective organizations is requested to have as many of their members attend as possible; also to select a committee of five members to form a general committee in their particular States and sections.

An announcement has been made by Mr. F. W. Coolbaugh, chairman of the Supply Men's Association, to the effect that arrangements have been completed to have a line of shafting for the convenience of exhibitors at the Mechanical Conventions at Saratoga in June. The cost of power to individual exhibitors will be very small. Those requiring power should apply at once to Mr. R. C. Blackall, D. & H. C. Company, Albany, N. Y.

The average distance a passenger travels during a single journey in this country is twenty-three miles.

Practical Letters from Practical Men.

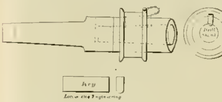
Facts Wanted. There's a glut of Opinions.

Write on one side of the paper, state your point plainly and briefly, and then quit. We supply the generalities. No letters noticed unless name and address are annexed.

Set-Screws on Drill Presses.

Editors:

I was interested in reading the account of the tube-hole cutter of Mr. Arthur, of Savannah, Ga., until I came to the set-screw to hold the tool from dropping out or twisting off the shank. I have seen men wound up by their clothes catching on that man-killer, and have forbidden one ever being put on a drill press under my care. I will give him a better idea than the set-screw. We use a great many Morse & Cleveland twist drills, and often have the flat ends twisted off. We then turn them down until they can be turned no farther for the flutes in the drill. So to remedy



the matter and save turning, I take the Morse drill socket and cut a slot in it 1¼ x 1¼ inches, so as to be about half way up on the taper shank of the drill; a steel key to fit the slot in the socket and into a half round groove cut in the drill or cutter shank, cut with a mill or half round chisel; then I have a collar with a key-way of the right taper which slips over the socket and on to the key. This keeps the key tight in the groove in drill shank, and if the groove is only cut the length of the key or a little over, the the tool cannot fall out. (See illustration). It is very simple, cannot get out of order; the old socket answers the purpose; new drills can be used, with or without this attachment. We have been using this for some time and it has never failed. The collar is turned out to make it light.

JNO. J. BINGLEY.

Watertown, N. Y.

Minor Shop Tools.

Editors:

One who is a reader of mechanical papers will notice that all devices and improvements in and on machinery are in the direction of having the machine do the work instead of the attendant, whose place is only to put the work in, wait until it is done, and then take it out and put in some more. This is the case with new machines, but as all shops do not have new tools, but old ones that long ago ought to have gone to the scrap heap, it is the place of the man in charge to see that he can get as many devices as possible to attain the desired end. He must also be able to take hold and work his device at first himself, or in nine cases out of ten it will prove a failure. Many small devices can be made at little cost, which help to make up for the want of the most approved tools. The production of a shop is greatly increased by minor labor-saving appliances, and every man responsible for getting out work ought to be interested in them.

Fig. 1 is what might be called a chuck for holding valves to face or end out. The post and outside is made of iron ¾ x 5 in., bent to the shape of a rectangle 7 x 18 in. On the inside the edges are planed and the end planed down as shown to 2¾ in. This is to accommodate clamps to hold the valve to the platen of planer. The set-screw in the end is to take the end thrust; the set-screws on the sides should slant down on the inside so as to draw down the valve. With this device a surface gauge need not be used.

Talking of valves, are they not getting to be an awful weight, not to speak of the weight of steam chest and covers, from what they used to be fifteen to twenty years ago? They are also getting to be so much higher up. Then a man and helper could lift off one; but what a job now if you do not have a traveling crane or a device as the one illustrated in Fig. 2, which is light and easily made. The yoke encircles the base of stack, and the outer end is 8 in. long x ½ x 2 in., the other end is a figure 2, with the upper end slotted to take a chain, and the lower end is 8 in. long, ½ x 2 in., two bars of ½ x 2½-inch iron 6 ft. long are riveted with 2 or 3½-inch rivets flush on lower side.

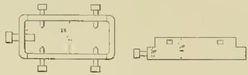


Fig. 1

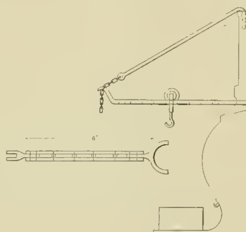


Fig. 2

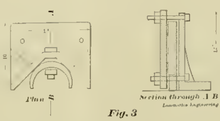


Fig. 3

MINOR SHOP TOOLS.

Thimbles are also put between bars and riveted at intervals of 6 or 8 in. holes to be countersunk and riveted flush. A pulley with center flange to run in groove and clevis to take block and fall. A piece of ¾ inch round iron with fork on one end bent to go down in stack 8 in., with 2 ft. of chain on the other end. With this you have something that you will miss if you should forget to take it off and it goes out with an engine; for, as one of the engineers said, it would be locked up in his tank-box before it got back; another wanted to know if they were not going to put one on every engine.

I would say to F. M. Arthur that the chuck (Fig. 3) for holding driving-brasses on slotter is one that we use, and the brass need not be squared. The base is 10 x 12 in. and the part that holds brass 12 in. high, with two webs down the back to stiffen it. The face should be finished on slotter; it is 2½ in., flat in the back, and 11 in. open in front, two holes for holding brass, one close to base and one side of the head of bolt taken off. On this bolt put a loose piece of iron for brass to rest on. The other hole should be high enough to clear the brass. A piece of iron 1 x 3 in. will serve for strap. Now, to put in brass, remove top bolt, put in the brass, replace bolt, screw up tight, and go to work. No surface gauge needed. In another number I will show how we hold driving-brasses on lathe to turn and bore.

W. A. ROBERTSON.

Cedar Rapids, Iowa.

Air-Brake Peculiarities.

Editors:

DEFECTIVE BRAKES ON ENGINE AND TENDER.

Has it ever occurred to our air-brake friends that engineers pulling trains entirely equipped with air—passenger trains, for instance—give but little attention to their engine and tender brakes? It is a matter of fact that passenger car brakes are more nicely adjusted and kept in better condition than the brakes on the engines that haul them. When a passenger engineer finds there is something wrong with his brakes, that they don't hold, he generally goes after the conductor and asks him to examine the cars and see if one or more of the brakes are not cut out. He expects the train to make the stops, and really would a little bit rather that the engine wouldn't "be in it." It is different with the freight engineers, they seldom have a full train of air, except, of course, on the mountain roads, and sometimes there is a train with no air-brakes at all but those of the engine, and naturally freight engineers are interested in having their engine and tender brakes as efficient as possible, but when all freight cars are air-equipped, will not freight engineers be as careless about their engine brakes as the passenger engineers are now?

A DRIVER-BRAKE DOES NOT HURT THE ENGINE.

The theory of long ago that driver-brakes are hard on an engine seems to live yet in the minds of our old passenger runners, and many of them don't know whether their engine brakes hold or not. When they get their engine out of the house to go out on their run they start their pump slowly and don't run up much pressure. Do their stopping with the reverse lever to work the water out of the cylinders until they couple on to train, and on the road the train-brakes make the stops.

WHEELS SLID BY DEFECTIVE BRAKE.

I was night hostler for quite a while. A certain engine and engineer came in on the same run every night, one of the oldest runners on the road. One night he brought his engine in and left her by the roundhouse, shutting off his air-pump before he left her. As soon as he was off I moved the engine down to the ash-pit and stopped her with the brake. When I went to start, I found the brake stuck. The engine and tender brakes were actuated by a single triple-valve and auxiliary reservoir, but the tender brake was set so tightly that the wheels slid, while the driver brakes were in perfect release. By loosening the pipe fitting at different points, I found that air pressure from the tender brake only passed as far as the hose between the engine and tender. The tender had one of those forms of brake-rigging where the push-rod is attached nearest to the fixed central fulcrum of a dead lever, with the pull rods connected to the ends of the lever. There was but little slack in the rigging, and it allowed such a short piston travel that with the hose leading to driver-brakes stopped up, there was but little room for expansion of the auxiliary air, and with a bad leak in the pipe connecting the train-pipe with the triple-valve, it was easy to understand why the tender brake should stick and slide the wheels while the driver-brakes were inoperative. I looked at the engineer's report of repairs wanted, and found nothing as to his brake, and I concluded that he had put a blind gasket in the hose fitting to cut out his driver-brake. The engine came in in the same condition every night for a week, when she was taken off the run and laid in for a few days to have her valves faced and have *two new pairs of wheels put under the tender*, etc. The morning she was laid up, I went down to the roundhouse, and the foreman, speaking of work laid out for that engine, incidentally remarked that there was work reported on nearly everything about the engine but the brake. He showed me how closely the tender and driver-brake shoes hugged the wheels, the pump had lately been overhauled, and so on. Then I told him about it, and he had the engine fired up immediately and put the air-brake men to work on her. They took a large piece of gummy waste out of the hose and they stopped the leak in the train-pipe, and the brake worked all right. It didn't take very long to do it. It looks like a matter of small importance, but it wasn't. I don't know, of course, what two new pairs of wheels cost, or the price paid for removing and replacing the wheels, but it is odd that the engineer ran his engine in such condition so long without noticing the disorder.

REAL CASE OF TURNING ANGLE-COCK.

I once fired a passenger engine whose brakes, independent driver and tender, were always in such poor condition that it was almost impossible to stop the train with an emergency application without breaking the Janney on the tender or the one it coupled with. We were on the same run every day, and on Saturday nights some young "toughs" would climb on the front end of the limited mail car next to the engine at our last stopping place on the road, ride about four miles to the village where they lived and then pull the air signal. Of course we would forget that it was Saturday night and about those fellows and would stop, when the boys would jump off and take to their heels. But one night we saw them get on, and the engineer said "I'll take those fellows to Terre Haute to-night." At the usual place the music began. The air-whistle played a regular tune. It was a heavy down-grade and the Old Man shut off and let her roll. At the foot of the grade the track was being raised and filled and there was a slow order for that place, but he intended to go over as fast as he dared, and with all confidence in the train brakes he let the train fall down that hill P. D. Q. The air-gauge showed a train-pipe pressure of 75 pounds before he applied the brake, and when he got pretty close to the [illegible] track he jammed the brake on [illegible] or rather, intended to. There was [illegible] little *swish* of air from the three-way [illegible] the black hand of the gauge was [illegible] zero. Those fellows on the front [illegible] the mail car, finding that the air-[illegible] hadn't the usual effect, began to [illegible] with the angle-cocks. They [illegible] brakes applied by turning the [illegible] end of train and thought they [illegible] the train by turning the angle-cocks [illegible] the engine and mail car. The [illegible] whistled for brakes, and the [illegible] responded by going after the [illegible] thinking the air had failed. [illegible] pull the conductor's valve, but [illegible] on good track again before the [illegible] reduced much. There might as [illegible] been no brake on the engine and [illegible] for all the good it did. We went [illegible] that piece of track with the en-[illegible] working in the back-motion on [illegible] that was the roughest ride I ever [illegible] the engine leaving the rails. [illegible] track at that place probably [illegible] collision a little later. When [illegible] stopped we opened the angle-cock [illegible] been closed, tried the brakes, [illegible] all right and started. It is [illegible] to say that those air-[illegible] of the front end had van-[illegible] they got spilled off going [illegible] corduroy track.

[illegible] its yard there was a railroad [illegible] approached by a curve, and the [illegible] of box cars in the side tracks ob-[illegible] a view of the crossing, which had [illegible] signal. Our card time was [illegible] through the yards, the brake was [illegible] applied until we neared the curve, and [illegible] night there was a train on the [illegible]. Having to slow up for that bad track undoubtedly prevented a wreck.

WHY BRAKES ON FREIGHT ENGINES ARE KEPT IN ORDER.

Now, even passenger runners should not depend on always being able to apply the brake on every car in their train, although the brakes may be in perfect condition before leaving. There is the "deadly angle-cock." Of course, trouble from that source is magnified, but the danger exists. A powerful brake on our modern heavy passenger engines goes a long ways toward stopping a train. Freight engineers know the effect of a good engine brake on a train of thirty or forty cars not equipped with air-brakes. While a hostler, I had the opportunity to notice the difference in the efficiency of the brakes on passenger and freight engines, and found but few passenger engines with really powerful brakes, while it was a rare thing to find a freight engine with a brake that did not hold good, and where there was such a one, there was certainly a report left for brake work.

WHY PUSH-DOWN DRIVER BRAKES HOLD BETTER THAN PULL-UPS.

The roundhouse foreman asked me once why it was that with eight-wheeled engines, push-down driver-brakes held better than the pull-ups. Such really is the case here, and my idea is this: nearly all the pull-up brakes are supplied with air from the tender triple and auxiliary, and the air expands in the three-brake cylinders to a lower pressure than it does with the push-down brakes, which have their own triples and auxiliary reservoirs and fewer pipes and fittings to work loose and leak. Of course, with the pull-up brake, the tender auxiliary is calculated to be of sufficient capacity to supply the three cylinders with the required pressure, but don't seem to do it. It is often placed under the tender where it is inconvenient for the engineman to drain it, and its air capacity is lessened by water collecting, while the driver-brake auxiliary may be drained without trouble.

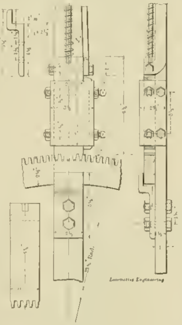
WILL W. WOOD.

Terre Haute, Ind.

Improved Reverse-Lever Quadrant.

Editors:

On many locomotives the reverse-lever quadrant notches are spaced considerably too far apart. One will notice that in hooking the latch from one notch to the succeeding one, a variation of three inches



and often more will be found in the cut-off. In these days, every point that denotes economy in fuel consumption is eagerly sought and profited by. It is true there are some very good reverse-lever latches and quadrants in use, but there are also some objections found with them. In designing the latch and quadrant herewith, the writer considered four very important elements. First, a close adjustment in the variation of the cut-off; second, increased bearing surface of the teeth and dog (with the teeth it is five times as much as on a common single toothed latch); third, its simplicity and cheapness of construction and future repairs; fourth, the quadrant can be turned end for end in case it becomes worn. It will be noticed that the teeth are spaced one-half inch, that is, the lever will move one-half inch at quadrant to engage the succeeding tooth in the quadrant. The quadrant is a single bar one inch or more wide, and the reverse-lever travels on one side of it. A bracket lug is bolted on the quadrant side of the lever to form a guide. The teeth in quadrant and dog are cut in a milling machine, and when cut accurately the dog will mesh with quadrant, so that there will be no danger of the teeth breaking out by violent or careless handling, there being five teeth in contact.

One of these levers and quadrants complete was constructed at a labor cost of $10.21, and put on an engine that had previously been cutting off at 8¾ inches. Now, the engine, doing the same service as formerly, cuts off at 7 inches, and does the work equally well in freight service. The first week, all other conditions being equal, this engine showed a gain of about six miles per ton of coal. We find a variation of one inch in the cut-off by hooking the dog in each succeeding notch in quadrant. This permits a wide open throttle and the steam can be controlled by the reverse-lever to a point where economy is best obtained. The merits of a close adjustment of the cut-off are conceded, and I will advise you later on what the gain will be in a longer space of time.

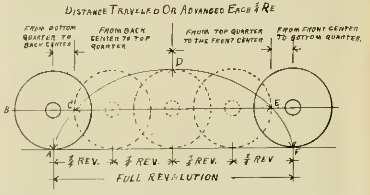
J. C. MILLER,
G. F., C. M. & St. P. Shops.

Dubuque, Iowa.

Top of Wheel Traveling Fastest.

Editors:

A question has been raised in LOCOMOTIVE ENGINEERING as to a wheel traveling faster at the top than at the bottom. I was asked by several men if I could explain why this occurred; so I concluded to send you the sketch I made showing the wheel through one revolution. As an illustration, this circumference or revolution I have divided into one-fourths.



The cycloid above shows the path the mark or dart at the bottom of the wheel at *A* will travel in this revolution. Notice, the wheel will not travel backward at all, but upward and forward in traveling from the bottom quarter to the back center, but will only travel the short distance from *A* to *C*, the distance this mark will travel directly forward is shown above. Now, from *C* to *D* this marked part of the wheel will travel rapidly forward and gradually upward to *D*, and it will travel ahead the distance shown above. Then, from *D* to *E* it will move rapidly forward and gradually downward to *E*, and will travel ahead the same distance as from *C* to *D*, as shown above. Then, from *E* to *F* the part moves slowly forward and downward to *F* at the bottom of the wheel and at the bottom quarter, and advances the short distance shown above.

A person can readily see from this illustration that the top of the wheel travels decidedly faster than the bottom.

Dubuque, Ia. CHAS. E. FOURNESS.

Hard and Easy Means of Removing Hard Bolts.

Editors:

Did it ever strike you or any of your readers how amusing it is to see the way frame, cylinder and other large bolts are generally taken out in railroad shops? The operation is an amusing spectacle to a man with an eye to the ridiculous phases of mechanics.

In most shops there are two or three men who are considered extra good strikers with a sledge, and whenever there is a set of frame or other bolts to be backed out the machinist who has the job takes a trip through shop, roundhouse and probably the boiler and blacksmith shops, and hunts up three or four sledges weighing from fifteen to forty pounds each.

The shop sledge, by the way, is of unknown quantity, and always of very poor quality, generally of one or two that have been discarded by the blacksmiths as useless and weighing about sixteen pounds. A couple of cast iron mauls, twenty-five or thirty pounds each, and a sledge that was originally made for the foundry to break up old car wheels, etc., with, and weighing anywhere in the neighborhood of forty pounds. The probability is that not more than one of this assortment has a whole handle in, and the chances are that it is loose.

The shop sledge should weigh from fifteen to twenty pounds. It should be double faced, with eye in the center. Spike driving is a section man's trade, so don't have your sledge drawn down to a point on the ends to resemble a spike maul, but have it made the same size at the ends as in the middle, with the exception of the corners, which should be taken off from near the center to the ends. Have a straight handle put in, and you will have a tool that the first car repairer who sees it will come down to the shop at night and steal, and then you can use the ones previously described, for nobody will ever steal them.

After the machinist has collected the sledges, two or three flatters and all the punches, with and without handles, that can be found, he goes after one of the heavy hitters and asks him to come down and strike a few blows for him.

The first thing the heavy man does is to look at the array of sledges. Of course his favorite one is not there, and so off he goes to find it, coming back in the course of half an hour with the information that "that d——n Dutchman has got it and won't loan it." As the machinist knows who is meant by "d——n Dutchman," he goes and interviews him, and after much persuasion and many promises to return it uninjured, he succeeds in obtaining the much prized instrument and returns with it triumphantly.

Now the fun commences. The striker, after carefully examining the bolt, picks up the sledge and hits it just once, then everybody examines it to see if it came any. Alas! no; so he goes to work in earnest.

By this time a crowd of spectators has gathered, consisting of machinists, boilermakers, helpers and possibly a foreman or two, all of whom render assistance by offering a word of encouragement and advice now and then, and also by helping to examine the bolt-head to see if it shows any signs of starting.

After twenty or thirty blows are struck, the welcome words are heard "That's the time she come." After driving it about half an inch, the striker rests while the end of the bolt is chipped off, for if it is not already broken off it is upset till it is about four sizes too big to go through the hole.

When the end is chipped, the sledge is brought into use again, and the bolt finally driven out.

The next one proves too much for the heavy man; and after every one on the job, and two or three ambitious spectators, have tried their hand at it, it is given up, the head is knocked off and it is left to be drilled. This process is gone through with each bolt, until all of them are either out or waiting to be drilled.

As a result of this method the holes are in such a shape that they need a great deal of reaming before they are ready for new bolts to be fitted.

If instead of main strength and awkwardness, the one doing the job will take the nuts off, put a little oil on the thread of the bolt, and also on the face of the nut, screw it back on again, and get a wrench that fits, and take a good pull (put a piece of pipe on the end of the wrench if necessary), he will find that the bolt can be stretched enough to loosen it, and then be driven out very easily, and the holes will be left in condition to require very little if any reaming. This is called stretching bolts out.

N. B.—Don't use the old bolts again.

F. C. CHARLES.

Cedar Rapids, Iowa.

Other Diseases of Air-Brake.

Editors:

In article "Diseases of the Air-Brake System," by Paul Synnestvedt, in March number, I noticed that Fig. 6 Plate II, shows handle 38 in position for releasing brake, while feed port *f f* is open and feed valve in operation. Since the latter is only possible when handle is in running position, will you kindly explain this seeming distortion, in your paper.

I recently found a defect in a feed-valve, which was rather troublesome to locate. It was impossible to adjust this valve with any accuracy, and train-pipe pressure constantly crept up to reservoir pressure. I found that spring 68 bound slightly in adjusting nut 70, and reversing spring 68 remedied the difficulty completely.

In the air-pump puzzle I sent you in February nuts—holding pistons on main valve stem—were loose, allowing pistons about $\frac{1}{16}$ play, causing pump to hammer.

Hyde Park, Mass. GEO. LYNCH.

Admitting Air to Steam Chest.

Editors:

In question No. 56 in March number you gave a fair explanation of how air got in the cylinders, but as the ports are covered, you do not explain how air gets in the steam chests. As there is no way for air to get in the steam chests except by the valves raising off the seats by the vacuum accumulating in the steam chests, caused by the pumping action of the piston, that is the reason I use a valve in the leakage holes of balance slide-valves to get a tight vacuum on top of the main valve.

Brooklyn, N. Y. D. KILEY.

To Tell the Number of Air Cars in Train.

Editors:

In your March issue I notice an article from Sam M. Huffman criticising the veracity of W. G. Wallace, how to tell if your air is coupled up, in which he states that by bringing the handle of engineer's valve from running position to full release the red hand will drop back one pound for each car. S. M. H. says this will do very well on short trains but not on long ones. S. M. H. is mistaken in this. It was in August, 1893, that I first commenced this practice. I have kept silent on the subject for fear some one would give me the laugh, but nevertheless it is true. I have practiced this every day and have proved it to my own satisfaction. I have the brakemen ascertain the number of air cars in the train, and after train line and auxiliary pressure is pumped up can tell within two cars of the full number in train. Twenty-two air cars is the most that I have had in a train. Do have from ten to twenty in all of our trains, and I can tell up to that number; and I do think that I can tell up to twenty-six or twenty-eight. I carry thirty pounds excess pressure. There are several of our men, both firemen, brakemen and conductors who will testify to these tests, also our trainmaster will bear me out in this. He is well posted on air himself, and he goes into the details, and I have proven it to his satisfaction. On one of my trips I had eighteen cars of air in the train. At this station we picked up and set out quite a number of cars, and took into train eight air, filling the number to eighteen. I did not see how many air cars there was picked up. The trainmaster, after the air was coupled up, came on to engine and asked if I could tell how many cars of air was then in train. I told him, and he said that he was satisfied that I could tell quite close. I have had the conductor ride on the engine with me, while his brakeman would cut off, and have me tell him how many. He had his brakemen on one occasion to partly close the angle-cock. They claimed that the angle-cock was almost closed. He then asked how many cars were cut out. After making the test, I told him that there was none of them cut out. He was well satisfied as to the results.

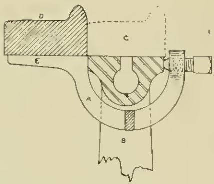
Now I think that this is proof enough to show S. M. H. that W. G. W. is correct.

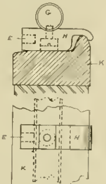
St. Paul, Minn. P. K. SULLIVAN.

Tire Handling Tools—An Eccentric Blade Bending Device.

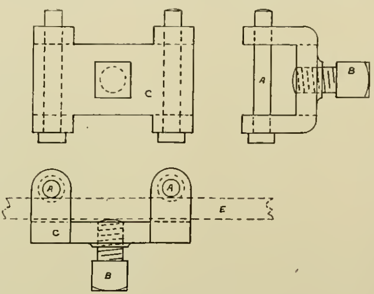
Editors:

How often when tires are to be put on locomotive driving wheels do we see six or eight men taking the tire from the fire (where an outside fire is used), all confusion and excitement in an endeavor to get





the tire on its wheel center before it cools off too much, so as to leave it with so little shrinkage as to make it almost impossible to get it on in time to properly set it. By the use of the device shown at Fig. 1 a great deal of this anxiety will be overcome. Referring to the drawing, *B* is the section of wheel center, *A* is a clamp secured as shown, *E* is a projection on the clamp long



enough to furnish a proper support to the tire.

When a tire is to be shrunk on, two of these clamps are put on the upper half of the wheel center, about 2 feet or 30 inches apart, with the top of the projection *E* in line with the outer edge of the center. As the tires become sufficiently heated, presuming them to be heated in a wood fire near by, they are taken up and hung on these two clamps and then simply pushed on the wheel center to the proper distance, the clamps acting as a guide and support.

When gas is used these clamps will be found still more useful. When a tire is to be removed two clamps are placed on the center as before stated, the iron pipe through which the gas is conducted is placed in position on the tire, which when sufficiently heated, without removing the pipe heater, is pulled off the wheel center on to the clamps, the pipe is then removed and the tire taken off by means of a hoist furnished with a plain L hook.

In putting tires on, the tire is hung on the clamps, the gas-pipe heater put in place, and when the tire is heated it is pushed on the wheel center the proper distance.

Where gas is used, the device shown at Fig. 2 will be found quite an advantage. Often the pipe heater is put on the wheel and a nut or loose blocks placed under it to keep it the proper distance from the tire. After a few minutes the pipe will be found to need a little adjusting, and it is pushed into proper position when one or more of these pieces will drop out of place, and it will be necessary to take it up with tongs and replace it. Again the pipe itself must be removed after the tire is heated. This must be done with tongs, as the pipe is too hot to be handled otherwise. By the use of the small cast-iron block shown at *H*, Fig. 3, the handling and adjusting of the pipe is made an easy matter. This block is secured to the pipe with a cheese-head bolt. One block is placed so as to rest on the top of the tire, and one on each side in the upper half circle just above the center of the wheel. By having each pipe or tire heater fitted with three of these blocks a great deal of time will be saved, as there will be no dropping out or replacing of hot irons. The hole *E* is to receive a piece of ½-inch round iron, to act as a handle, by which means the pipes are conveniently moved and placed in position, doing away with tongs and burnt fingers.

ECCENTRIC BLADE STRAIGHTENER.

In Fig. 3 is shown a tool by the use of which the time required for valve setting will be shortened in every shop in which it is used. It is intended for setting or straightening eccentric rods. It is often found that the rods have more lateral play on one side of the link than on the other, and it then becomes necessary to remove the rods and have the blacksmith set them. By the use of this tool this work can be done under the engine and without removing the rod. Referring to the drawing, *A A* are pins which are taken out and the clamp put over the rod *E*, the pins then being replaced, and the screw *B* set against the rod *E* sufficiently hard to give the required set. F. M. ARTHUR.

Reading, Pa.

Using Air with the Vreeland Jack.

Editors:

We wish to emphasize somewhat the final lines of your P. S. regarding "Some Handy Tools Handled by Air," page 136 of the April copy of your paper just received. The tool is covered by the patents of Mr. Vreeland, and the railroad company will be notified of this. We wish to give notice that it is covered by a patent that there may not be unnecessary trouble. We stand ready to furnish a tool driven by compressed air, if the roads desire it in that shape, at the same prices that we would get for the other.

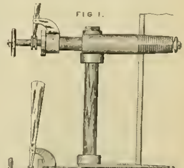
THE W. & S. HYD. MACH. WORKS.
Per Watson & Stillman.

Malone's Water-Glass Attachments.

Editors:

I send you a print of an improvement in water-glasses or cocks patented to me. You will see by a glance at the print that this cock has no threads on stem or rod, so the seat cannot be injured by being screwed in against scale or other hard substance by inexperienced handlers. In fact, the more it is turned the better the seat, as turning will grind it in. When the cocks are open and water and steam in

FIG 1.



them, the pressure is the same to the square inch in cocks and glass as in boiler, thereby creating a balance and rendering the action of cocks automatic.

The barrels of cocks extend into and beyond the sheet a sufficient distance that, if broken off outside of sheet, there will remain enough of the barrel and rod inside of boiler to insure valve coming to seat evenly, rendering the cocks automatic if broken off. The rod running through the barrel is a three-cornered or three-edged one, and is designed to be turned to cut the scale and lime out of the cocks, and it may then be blown out through valve. I. M. MALONE.

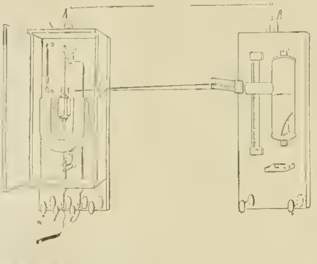
Raton, New Mexico.

The contributions to our correspondence columns are becoming embarrassingly voluminous. We have been doing rigid selecting lately and condensing all the letters that could be put into smaller space, but we still find ourselves compelled to leave several good letters over.

The Queen-Le Chatelier Pyrometer.

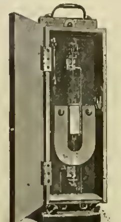
Modern investigation and many of our modern industries demand an instrument for the accurate measurement of very high temperatures.

A vast amount of experimental work in this line has been done by physicists and metallurgists in the past, their most noteworthy results having been achieved by the employment of the air or gas thermometer, which depends for its action upon the expansion of air instead of mercury, as in the ordinary form of thermometers. The bulbs of these thermometers are constructed of materials like glass or platinum, whose melting points are very high. In the more recent experiments, however, porcelain bulbs were used.



[illegible] thermometers are not con[illegible] instruments, requiring, [illegible] great deal of subsidiary ap[illegible] the application of many cor[illegible] readings.

[illegible], however, eminent scientists [illegible] invaluable service by estab[illegible] fixed temperatures, such as [illegible] points of various metals. [illegible] be relied upon in graduating other forms of pyrometers.



M. Le Chatelier in constructing his pyrometer has made use of these known melting points.

It is based upon the principle of measuring the electric current generated by the heating of a thermo-electric junction. As modified by Queen & Co., it consists of a thermo-electric couple and a D'Arsonval galvanometer. The wires which compose the couple are one of pure platinum, and the other platinum alloyed with 10 per cent. rhodium, both of which are perfectly homogeneous.

For use, the couple, which has been first connected with the galvanometer, is inserted into the furnace or oven, when immediately a current is produced and measured on the galvanometer scale, from which the temperature is readily deduced.

The pyrometer has the following advantages:

1st. It is adapted for a very large range of temperature, *i. e.*, from 200° to 3,000° Fahr., but it is intended more especially for high temperatures such as are met with in the manufacture of metals, chemicals, porcelain ware, etc.

2d. It is almost instantaneous in its indications, five seconds being sufficient time to subject the couple to any stationary temperature, or the couple may, if desired, be left permanently in the furnace or oven, indicating at all times the temperature, and thus enabling the operator to keep an hourly record of same.

3d. The metals which compose the couple are not affected by gases, and hence will not become oxidized or react chemically on each other at high temperatures, nor are they altered in their thermo-electric properties by rough usage or bends.

From the above statements it will be readily seen that the instrument is of great accuracy and durability.

The measurement of the temperature is made by means of a D'Arsonval galvanometer, contained in two wooden boxes, which are screwed against a central wall or slab, with handle for portability as shown in Fig. 1.

Fig. 2 shows the two boxes unscrewed from the central slab and placed in their respective positions against the wall.

Box A contains the galvanometer proper, and is also provided with set screws and a small plumb-bob, so that it may be set vertically.

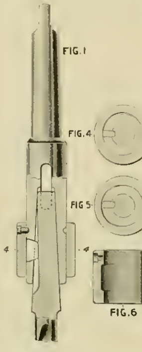
Box B contains the lamp, having a lens and window with cross-hairs for throwing an image upon the galvanometer mirror in Box A, which, in turn, reflects it back upon the scale in Box B. Box B has also two sets of screws for adjusting it vertically. The two boxes are set one meter apart.

The current set up by the thermo electric couple (no battery is used) enters the galvanometer through the two binding posts, Box A, and the deflection caused by it is shown upon the scale, Box B. This scale is graduated in millimeters, and it is necessary, therefore, that a curve be made reducing these millimeters to degrees Fahrenheit or Centigrade. This curve is very simply made from known melting points given herewith: Water boils, 212° F., lead melts, 617° F., zinc melts, 779° F., gold melts, 1913° F., palladium melts, 2732° F.

This instrument is fully described in a pamphlet on pyrometers published by Queen & Co., Incorporated, of Philadelphia. We strongly advise those who are interested in heat measurements to obtain the pamphlet. The subject of heat measurement is an interesting one, which does not receive the attention it deserves. The pamphlet referred to gives valuable information on the subject.

New Method of Driving Drills.

Every mechanic knows that the weakest point about the ordinary taper shank twist drill is the flattened end of the shank, which frequently twists off long before the drill is worn out, or if it does not, it will often cut or ream out the flat recess in the socket. In either event the drill or the socket are forever after useless, until considerable expense has been put on them in the way of repairs. The Cleveland Twist Drill Company, fully alive to the demands of the times, have gotten up what they call a grip socket that entirely overcomes this, the only weak point in the modern system of taper shanks. This grip socket is fully shown in the illustrations. A steel key is let into one side of the ordinary socket and its inner side engages in a groove or flattened place prepared for it on the shank of the drill. A slight turn of the eccentrically counterbored sleeve or collar fastens or locks the key securely in its seat, and then the drill cannot be turned in its socket or pulled out. This key is so located in the body of the socket that the



tang on the drill will fit into the usual slot or recess prepared for it, and in this way the socket has a double driving-power. The advantages arising from the fact that the drill cannot be pulled out till the collar is turned back and the key released are many, as heavy tools have a provoking way of dropping out of their sockets at most inopportune times, and many drills are dulled or spoiled by tapping them into place by a hammer.

If this simple drilling device is put directly on to the drilling machine spindle, heavy undercutting can be done with boring bars and the labor necessary to turn over heavy castings entirely avoided. These grip sockets will hold just as perfectly and securely straight shank drills, and can be furnished with ½, ⅝, ¾, ⅞ and 1-inch holes for straight shank drills. The company propose to put this necessary groove in the shanks of all their drills so that they can be used in these grip sockets, just as the purchaser may prefer. A drill that has had the tang twisted off, can be made as good as new for use in this grip socket by milling a half-round groove in the shank, or if it is not convenient to mill it, a flat place can be filed or ground in the shank, care being taken that such groove or flat place has a taper the reverse of that on the outside of shank, as shown in the section drawing of the illustration. The small cut illustrates the reducer or shell sockets used with the "grip." The Twist Drill Company have applied the gripping device directly to several drill press spindles, and will furnish collars properly constructed for that purpose on application at a very trifling expense. They have put in special machinery for making these "grips," and as all parts will be made to jigs or standards, they can furnish duplicate parts at any time. Patent applied for and all rights reserved by Cleveland Twist Drill Company, Cleveland, O.

The Most Economical Load for a Locomotive.

A very valuable, practical and interesting discussion was started in the New York Railroad Club, by a paper from Mr. Geo. W. West, superintendent of motive power of the New York, Ontario & Western, on "What is the Most Economical Load for the Locomotive from the Standpoint of the Motive Power and the Transportation Departments?"

Mr. West contended that the necessity for the means of starting abnormally heavy trains and the power to surmount steep grades is leading to the over-cylindering of locomotives. "Have you ever thought," he continued, "that in the seventies, a 16-inch cylinder was counted big, and how it taxed the designers of locomotives to get boilers large enough to furnish steam for them. Now 20-inch and 21 inch are common, and still boilers are built that supply them. But how? Not worked as men used to work the engines with 16-inch cylinders at nearly full stroke.

"This, in my opinion, is the stumbling-block, or whatever you may call it, that leads to a difference of opinion as to what is a load for a locomotive; for anything that is an overload cannot be economical. I have been on engines with division superintendents when they would say to an engineer, climbing a heavy grade, and noticed the engine slacking yet holding up full boiler pressure, 'Why don't you drop her down a notch or two?' And the engineer would reply: 'If I do I must put on the second injector, and if that is done she will go back in steam.' I have seen men insist on the lever being dropped down, with the result as predicted—out of steam. Now, if there is anything that grinds a master mechanic or superintendent of motive power, it is to examine the morning reports and see half a dozen or more engines reported losing time up Oneida Hill or Rock Tavern Grade on account of 'no steam,' he knowing the engine is in good order, and the only reason in his mind for being shy on steam is that the yardmaster has just measured off a mile or less of cars, without any regard to their capacity, and in his opinion it should not be reported as 'no steam,' but an 'overload.'

On the other hand, the superintendent will say to the yardmaster "I notice, by the speed-recorder tapes, that Smith, last night, on 36 with engine '172,' ran over the division with forty cars at passenger train speed; you had better add a car or two to the train."

"Next night Smith starts out with another train of forty cars, and lays down, as they call it, for steam. Dispatcher asks the conductor what's the matter with the 172 and receives the reply, 'no steam.' Engineer and conductor called into office next day and asked to explain; their explanation is that the night they made the good run they had forty cars of merchandise freight and good rail, and the night they failed had a train of sugar or oil, wet rail, used all the sand they had, had to double Carey's grade, and everything went crosswise.

Pulling Down an Old-Time Locomotive Shop.

"The men in charge of motive power are naturally interested these times, when their reputation is at stake, on making the engines under their charge show the greatest number of miles run between shopping, in other words, the most miles at least cost, regardless whether the company is earning any money from that class of traffic. On the other hand, the heads of transportation departments of to-day, in order to keep up the standard of other men or even of their own records of three or four years ago, are compelled to overload the engine on account of the greater number of large capacity cars coming into use."

Mr. Bradley, West Shore, favored loading engines according to tonnage and not by the number of cars.

Mr. A. E. Mitchell, Erie, believed that the condition of rail and weather ought to be considered in loading a locomotive. He did not think that a locomotive could be strained by hard pulling.

Mr. Wattson, West Shore, intimated that on their road the way-bills were in the hands of the yardmaster when he was making up a train, and that the weight of the cars regulated the number assigned to the engine.

Mr. Geo. Fowler mentioned a case where a man took a contract to keep a certain road in brass, oil and waste. To make money he put in the best material to be found. The result was that engines which formerly hauled only fourteen cars over a certain grade got to pulling eighteen. At the end of the contract the purchasing agent insisted that they were paying too much money, so a new contract was made with a cheap man, and the haulage of cars soon dropped back to fourteen cars again.

Mr. Mendenhall believed in the trains being regulated by weight, but he did not think that the ordinary yardmaster was discriminating enough in assigning loads.

Mr. Bradley gave an item from his experience when he was a conductor. He had an engineer named Howard. They were pulling a great deal of flour and leather. When he wanted to make a good run he told Howard that all the cars were loaded with leather, and they got there promptly, no matter if flour filled most of the cars.

Mr. Mitchell mentioned a case where they were trying the capacity of a new engine and had loaded it by the stenciled weight of empty cars. The engine did not seem to be equal to the work and he had some of the cars weighed. Those stenciled for 30,000 light weight weighed about 38,000 pounds.

Mr. Joughins believed that the speed required was not taken sufficiently into account when loading locomotives. A locomotive with one car will consume a great deal of fuel going at twenty miles an hour, whereas, if you put thirty or forty cars on that locomotive it will consume, of course, more fuel, but the economy obtained in moving those cars is very marked indeed. We make out a rather elaborate performance sheet on our road, and in looking at that performance sheet from month to month I can, with a great deal of certainty, tell by merely looking at the amount of coal consumed per car per mile whether we are doing a large business on these trains or not. If the amount of coal consumed per car mile is small I know that we are hauling big trains. We have a road which is not much troubled with grades, and therefore we do not hesitate to put sixty or seventy cars on the engine, and we find that as the load increases the cost per car mile decreases, until we get at such a load that we cannot make time. Then we have to stop increasing the load. Of course, it is a very difficult matter to say what a locomotive ought to haul from day to day. The season of the year, the condition of the rail and other variables make it impossible, I think, to determine with accuracy what a locomotive ought to haul, and I hardly think it is practicable to weigh each car before we apply it to the train.

Mr. Colvin—On the Erie road, years ago, when it was a broad-gauge road, and when they had no foreign cars, it was quite easy to load their cars very nicely. Almost every man here believes, I am sure, that one engine can pull one car with thirty tons easier than three cars with ten tons each. There is hardly any road but what the hill that limits the weights of trains is located within one mile on the road, and it seems to me that the economical load to put on a locomotive is the train that it is possible for it to get over that particular grade. Such a train would be so much more economical on 95 per cent. of the road as to much more than counterbalance any non-economical point in working over that grade. I am not speaking in the interests of the motive power or the transportation departments, but of the company, that pays all the bills.

Changes in Schenectady Locomotive Works.

The Schenectady Locomotive Works are improving the opportunity of the dull times by replacing their old machine shop with a new two story modern structure built of steel frame work and brick filling. The new building will be 80 feet in width by 368 feet in length.

The first floor will have two Sellers' electric cranes, traveling the entire length of the building, and covering all the heavy tools used on locomotive frames and driving-wheels.

The Phœnix Iron Company of Philadelphia have the contract for the steel frame-work of the building, while the masonry is being done by a local builder. The B. F. Sturtevant Company, of Boston, are furnishing their blower system of steam heating, which is used with success in a number of other departments of the works.

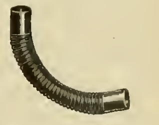
The old machine shop, now demolished, was built in 1866, replacing a structure which at that time was destroyed by fire.

The machine tools have been temporarily transferred to other buildings and set up, so no delay in filling orders will be experienced during the construction of the building. It is expected the new building will be completed in June. With the completion of this building, these works will be the most modern in buildings and equipment in this country, if not in the world, the entire plant having been practically rebuilt and equipped with new tools during the past ten or twelve years. The works are also about to receive a large hydraulic flanging plant, for flanging boiler work, which is about completed by the Morgan Engineering Company, Alliance, Ohio. This is the largest and most modern plant of its kind ever constructed for this purpose.

Anaconda Engine and Tender Hose Connection.

This hose illustrated was made at the suggestion of one of the leading superintendents of motive power in this country, who has equipped his engines with this hose. It is certainly filling a long-felt want for engine and tender connections, owing to the fact that it will not collapse and kink under any conditions, consequently it will never break or shut off injectors, the importance of which every railroad man fully understands.

This hose is made in the exact lengths required, and the ends for a distance of



about 2½ inches are plain—the same as on the ordinary plain hose. This is so that the fittings, clamps, etc., will fit this hose, same as the ordinary 3 or 4-ply hose.

This hose is made of good quality material, the duck on the outside will prevent grease and other substances disintegrating it. It should wear in service several years.

Improved Connelly Boiler.

We have received from Mr. J. T. Connelly a pencil sketch showing a modification of his well-known locomotive boiler. The boiler is straight and is rather notable for the short distance between the crown sheet of the firebox and the outside shell. The form of design adopted has been taken for the purpose of giving as large heating surface as possible. Writing on this point, Mr. Connelly says the common opinion is that a large space for steam is indispensable to the efficiency of the locomotive boiler. Assuming that belief to be correct, why not increase its present size and make it agree with the dimensions of the engine? Lack of steam is what prevents our engines from doing the work successfully. The boiler is likened to a storehouse upon which we may draw for supplies. Unless there is a good storage when approaching a heavy grade the steam is likely to fall twenty or thirty pounds, and the engine fails to take the train over in consequence.

The fact is, there is generally too much space for steam without the steam, and too little heating surface. The design of this boiler obviates this short-coming.

In the northern district of Manitoba dog trains are still in use, and very satisfactory is the time made by the animals, who skim over the frozen snow at a rapid rate. A train arriving at Stanley covered 350 miles in four days—well on to ninety miles a day. The railway has opened up communication with the settled districts in southern Manitoba, but the dog continues to supply the best means of transit for passengers and mails in the sparsely settled regions.

? A. What You Want to Know. ? A.

Don't ask questions that simply require a little figuring to determine, make each question separate. No notice taken of anonymous questions.

(76) F. E. W., Menomonie, Wis., writes:
Will you give me a mixture of some kind for painting brass work in the cab so that it will not scale off? *A.*—Try asphaltum varnish.

(77) J. G. M., Chicago, writes:
From what point of the valve-face would you measure in order to ascertain the amount of the inside lap? *A.*—This is answered in Answer No. 70, of April.

(78) J. H. H., Concord, N. H., writes:
Will you give me a good method of soldering two pieces of brass together by using common solder. *A.*—Clean the surfaces thoroughly, tin them over and use borax as a flux.

(79) A. J., Dallas, Tex., writes:
Will you tell me if a narrow gauge locomotive of the same tonnage will pull as much as a standard gauge engine, everything else being equal? *A.*—Yes. The power will be the same.

(80) J. W. B., Winnepeg, Man., writes:
Is it possible by exact mathematical methods to square any given circle, and if so, what method should be followed? *A.*—If the question relates to the size of a square which any circle will make it can be done by taking the square root of the area. If the question relates to the old idiotic fad of squaring a circle, we do not care to say anything about it.

(81) E. B. H., Belle Centre, O., writes:
1. Will an engine exhaust earlier in the stroke when hooked up than when running at full stroke? *A.*—Yes. 2. Will the lead of a perfect engine be decreased when it is hooked up? *A.*—We do not know what you mean by a perfect engine, but with ordinary locomotives and with ordinary shifting link motion the lead is increased as the engine is hooked up.

(82) Apprentice, Louisville, Ky., asks:
What is the Walschaert valve motion, and in what respect is it better than the link motion? *A.*—The Walschaert motion actuates the valve by means of a single eccentric and a connection with the crosshead. The only claim we ever heard advanced for its being superior to the link is in its producing a constant lead. We do not consider this feature of any advantage.

(83) A. R. M., Philadelphia, Pa., writes:
What is angular advance of eccentrics? *A.*—If a valve had no lap the eccentric would be set with the full part at right angles to the crank. The lap and lead require that the eccentric be advanced sufficiently to cause the valve to admit steam at the beginning of the stroke. The number of degrees the eccentric has to be advanced for this purpose is called the "angular advance."

(84) A. S. B., Spokane, Wash., writes:
Is there any way that I could obtain a general knowledge of chemistry without much study? *A.*—A king once asked Euclid, the famous mathematician, if there was not some easy way to learning the problems which Euclid had given to the world, and was informed that "There is no royal road to geometry." The same might be said about chemistry. It is a great science, which can be mastered only by hard and persistent effort. Any one merely wishing to know what chemistry is can get a fair idea by going through Roscoe's Science Primer on the subject.

(85) Engineer, Buffalo, N. Y., writes:
In connection with the discussions going on about the hammer blow due to the counterbalance, I have heard the suggestion that the reciprocating parts be made of aluminum. Do you think this is practicable, and that it would pay railroad companies? *A.*—An alloy of aluminum might be used in pistons and crossheads that would reduce the weight. Pure aluminum is not strong enough. We think steel is the most promising material to be employed in reducing the weight of reciprocating parts. For a given weight it has strength far beyond any other metal.

(86) C. W. H., Sayre, Pa., writes:
1. Please state which is the best way to fasten a valve-stem when covering parts on an engine with metallic packing, where there is no arrangement for the purpose? *A.*—This might be accomplished in different slipshod ways, but no engineer with metallic packing has a right to be found on the road without a clamp for holding the valve stem in position. 2. What part does the lower chamber to a Westinghouse triple-valve perform, and what is the spring in this chamber for? *A.*—The chamber acts as a drip reservoir, and the spring cushions the blow from the triple-valve.

(87) B. N. Y. L., New York City, writes:
I want to know the difference in weight of a pound of steam and a pound of water, and the amount of space occupied by each of them. *A.*—There is about the same difference in weight between a pound of steam and a pound of water as there is between a pound of chalk and a pound of cheese. A pound of water at its greatest density has a volume of 27.7 cubic inches. When converted into steam at atmospheric pressure its volume is increased 1,644 times, steam at 100 pounds pressure has 273 times the volume of the water; at 300 pounds pressure the steam occupies only 97 times the volume of the water.

(88) J. P., Ludlow, Ky., writes:
Will you give for the benefit of several of your readers a clear definition of the word "stress" as we find it used in engineering books and papers? *A.*—"Stress" is an abbreviation of the word distress, and Rankin explains it as, "Force exerted in any direction or manner between contiguous bodies or parts of bodies, and taking specific names according to its direction or mode of action." There is the tensile stress, caused by pulling, the compressive stress, such as that borne by a jack under a load, the shearing or tangential stress, that boiler rivets are subjected to, and the volumetric stress, which a body is subjected to entirely inside of a boiler or of a hydrostatic press.

(89) Student, Brooklyn, N. Y., writes:
We have been talking about your article on cylinder condensation, and several remedies have been suggested. We understand that English locomotive builders use inside cylinders because the heat from the smoke-box helps to keep the cylinders warm, and prevents the losses from condensation. Now, why can't American builders make a casing round the cylinders, and cause the gases from the tubes to flow through the casing and keep the cylinders hot? Is this plan original? Is there any practical objection to it? *A.*—The plan has been tried repeatedly with American locomotives without the proof being made of any apparent saving. Tests of improvements on locomotives have, however, been carried out so unsatisfactorily that the effect of keeping the cylinders warm is in doubt. We believe that material saving would be effected.

A railroad man in Utah sends us a paper with a description of an improvement to the Westinghouse air-brake which has been patented by a Utah inventor. Its purpose is to keep a better hold of the train on a steep grade while the engineer is recharging the auxiliary reservoirs.

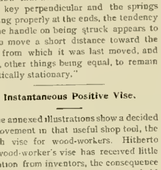
Moving the Angle-cock by Vibration.

Mr. George Holmes, of Roanoke, Va., writes:

"In the December number of the LOCOMOTIVE ENGINEERING I mentioned the fact that I was experimenting with angle-cocks, in order to learn, if possible, why they would close, and stated that right or left hand-wound springs would open or close them. I am now led to believe that this was not the greatest factor in the results obtained, but were acted upon by something else that I can not as yet satisfactorily explain. At any rate, other experiments go to show that with the axis of the angle-cock key perpendicular and the springs bearing properly at the ends, the tendency of the handle on being struck appears to be to move a short distance toward the side from which it was last moved, and then, other things being equal, to remain practically stationary."

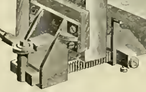
Instantaneous Positive Vise.

The annexed illustrations show a decided improvement in that useful shop tool, the bench vise for wood-workers. Hitherto the wood-worker's vise has received little attention from inventors, the consequence being that many of the tools in use hold the work so loosely and are so clumsy to handle that much time is wasted over it.



The peculiarities of this vise are that it takes work in instantly and holds it firmly and parallel, two very important features.

The mode of action is as follows: The work is put between the jaws and the construction of the vise being such the work



will not fall off, unlike other vises where you have to hold the work while you fasten it; you then take hold of handle and push up to the face of the bench, and by giving the handle a slight turn the work is instantly held tight and firm, the harder you push on handle the tighter it holds.

To *release* the work the handle is slightly pulled toward you, and when standing in front of the bench is entirely out of the way.

The vise is made by Henry C. Ayer & Gleason Co., Philadelphia, Pa. They will send a vise on trial to any responsible firm.

How Firemen Should be Selected.

At the New York Railroad Club, Mr. W. C. Wattson, superintendent of the West Shore Railroad, read a paper on "From What Class of Railroad Employés Should Firemen be Selected?" After a few introductory remarks, he said:

"In considering this subject we should practically have the locomotive engineer, rather than the fireman, in view, because probably 99 per cent. of the men who become locomotive engineers in this country are now advanced from the ranks of the firemen, and probably 75 per cent. of the locomotive firemen ultimately become engineers. Therefore, upon the selection of firemen, depends the character of the engineer. And upon the character of the engineer depends more largely than on any other class of employés the safe operation of our roads. Also, that the demands upon the resources of the engineer are being gradually increased, both with reference to him as a factor of safety and of economical administration.

"The title of my subject implies that the locomotive fireman should be selected from among the employés on the road and I believe that to be the best practice.

"First proposition—The locomotive fireman should invariably be selected from employés engaged in road service.

"Second proposition—Locomotive firemen should be selected from among the men filling the position of head brakeman on freight trains. This proposition anticipates that the position of head brakeman on freight trains shall be filled by men who have been especially selected with reference to their fitness for firemen, and that while they are filling the position of head brakeman they will be on probation or trial for the purpose of ascertaining, as nearly as possible, whether they are the right kind of timber to grow up to be engineers or not.

"Third proposition—In selecting firemen the man's promise of becoming a good runner should be the controlling consideration, and that everything else should be subordinate to this essential requisite.

"Fourth proposition—As a general rule, the fireman who has the least promise of becoming a satisfactory engineer is the one who is selected from the ranks of the engine wipers."

In the discussion that followed the reading of this paper, the transportation men favored selecting the firemen from brakemen, and the mechanical men expressed a preference for the promotion of wipers. The general sentiment was that machinists are no longer needed as engineers. Some of the members objected to firemen being selected from any single class. They preferred the best young men they could find, no matter what their previous occupation may have been.

A Conductor Who Defended His Money.

Tom Robinson is a thick-set freight conductor on a run that takes him through the verdant New Jersey meadows, and accords him the distinction of living in the lively regions where Jersey City ends and Hoboken begins. Tom is something of a joker, and says his home is the liveliest place on the mainland, for there are swarms of mosquitoes of the Jersey breed about the house all the year round.

No man in the service is more attentive to rules than Tom, but the rule against going into saloons while off duty he has considered an infringement of his personal liberty. Not that he is a drinking man, but he had a habit of looking into the little saloon on the corner while on his way home and indulging in a glass of beer. This saloon was the resort principally of men of low degree, and Tom was considered the most aristocratic patron. The habitués of the place naturally envied Tom, and coveted the wealth a railroad conductor must necessarily possess.

One night, as Tom was crossing some vacant lots between the saloon and his mansion, two enterprising voters of the region jumped upon him and demanded that he empty his pockets into their hands. Instead of doing that he smote them from head to heel with all the weapons that nature had provided. After a violent conflict a well directed blow from a cudgel laid him low, and the ruffians were victors. They carefully examined the pockets of the prostrate conductor, and all they found was a dime and two cents. They were the most disgusted brace of ruffians in Jersey. They had received about $10 worth of blows and gathered in only a few cents. "Be Jases," groaned one of them as he limped sadly away, "if the fellow had had a dollar in his pocket he wud av kilt us both."

Important Car-Heating Patent Decision.

At a session of the Circuit Court of the United States for the Eastern District of Michigan, continued and held, pursuant to adjournment, at the District Court Room, in the City of Detroit, on Tuesday, the tenth day of April, in the year one thousand eight hundred and ninety-four.

Present—The Hon. HENRY H. SWAN, *District Judge.*

CONSOLIDATED CAR-HEATING COMPANY,
vs. No. 3265.
MICHIGAN CENTRAL RAILROAD COMPANY.

This cause came on to be heard and was argued by counsel for complainant and defendant, and thereupon upon due consideration thereof it is ordered, adjudged and decreed as follows, viz.

1. That the Letters Patent No. 329,017, granted on the 27th day of October, 1885, to Elmore D. Cody and John W. Hayes, assignee for a one-half interest therein for a new and useful improvement in steam car-heaters are a good and valid Letters Patent, and are now owned by complainant.

2. That the defendant has infringed the rights secured to the owners of said patent.

3. That the said Elmore D. Cody was the first and true inventor of the improvements in car-heating described and claimed therein, and especially those claimed in the second claim thereof.

4. And it is further ordered, adjudged and decreed that the said defendant, The Michigan Central Railroad Company, its officers, agents, servants, workmen and attorneys be, and the same are each and every one of them hereby perpetually enjoined and ordered to desist from making, using or selling in any manner or form whatever, any car-heating system or apparatus described and claimed in said Letters Patent, and especially any form of continuous car-heating apparatus employing or taking steam from the locomotive through a continuous train-pipe, in combination with the upper and lower courses of side coils within the cars, with intermediate connections near the center of the car, between the upper courses of the said coils and the supply-pipe, and with an automatic steam-trap under the central portion of the car and intermediate connections between the lower courses of the side coils and said trap; and that the usual writ of permanent injunction issue out of this Court directed to the Michigan Central Railroad Company, its officers, agents, servants, workmen or attorneys, ordering them and each of them to desist from making, using or selling the inventions described in said Letters Patent, and especially those claimed in the second claim thereof.

5. And it is further ordered that the complainant do recover from the defendant all damages which it has sustained by reason of said infringment, and all profits which the defendant has made by and due to said infringement and the employment wrongfully of the said invention, and that said complainant have an accounting therefor, and that it be referred to Walter S. Harsha, who is hereby, at the request of parties appointed Special Master for that purpose, to take an accounting thereon and to report to this Court with all convenient speed the amount of damages suffered thereby by complainant and the amount of profits earned thereby by the defendant. And that said Master be empowered to examine such witnesses as may be summoned or produced before him, and to require the production of such books, accounts or papers as shall be competent evidence thereon.

HENRY H. SWAN,
District Judge.

Detroit, April 10, 1894.

United States of America.
IN THE CIRCUIT COURT OF THE UNITED STATES.
FOR THE EASTERN DISTRICT OF MICHIGAN.
IN EQUITY.

CONSOLIDATED CAR-HEATING COMPANY.
vs. No. 3265.
MICHIGAN CENTRAL RAILROAD COMPANY.

EASTERN DISTRICT OF MICHIGAN, *ss.*

I, WALTER S. HARSHA, Clerk of the Circuit Court of the United States, for the Eastern District of Michigan, do hereby certify, that the above and foregoing is a true copy of the decree in the above entitled cause, as the same appears on record in my office, that I have compared the same with the original entry, and it is a true and correct transcript therefrom and of the whole thereof.

In testimony whereof, I have hereunto set my hand and affixed the seal of said Court, at Detroit, in said District, this Tenth day of April, in the year of our Lord, one thousand eight hundred and ninety-four, and of the Independence of the United States of America, the one hundred and eighteenth.

Clerk.

This issue of the paper is gotten out slightly ahead of time to give us more days to get into our new offices at 256 Broadway. LOCOMOTIVE ENGINEERING has grown so fast that the old offices at 912 Temple Court have been far too small for the past year. All friends of the paper are expected to call when in the city. Visitors furnishing their own cigars will be treated to Croton water gratis.

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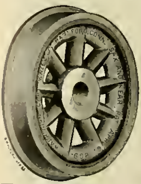

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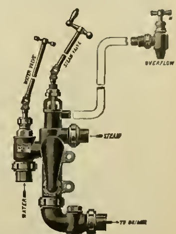

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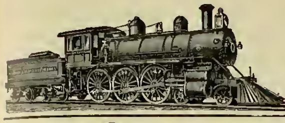

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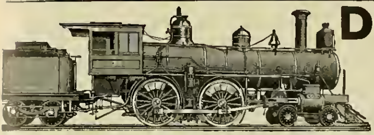

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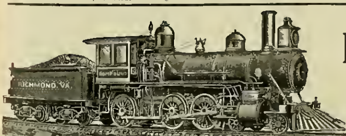

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Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock.

VOL. VII, No. 6. NEW YORK, JUNE, 1894. 20 Cts. Monthly. $2.00 Per Year.

A Trip in Old Mexico.

[EDITORIAL CORRESPONDENCE.]

SOME GENERALITIES.

I am afraid that I went to Mexico with about the usual ignorance of the size, importance, interest and climate of the country, and of the habits and customs of the people that I was going to see.

Most people living under the glorious old Stars and Stripes are willing to know that the United States is the biggest thing in North America, and mentally add, "All of which I know and part of which I am."

Few of us remember much about Mexico except as a red strip of map in the old geography. I recall that in my brief school days, with half shut eyes and wandering thoughts, I have looked at the map of North America, when it seemed for all the world like a great big tadpole—with Mexico for the tail.

As we grow older, we come more and more to measure things by comparisons—by others with which we are familiar. Years and years ago, when I was young, I used to measure every building by the old, white, country school-house at home, and that habit clings to me still. Just now, as I looked out of the window of my office, in the fifteenth story of a great building, I found myself thinking that it was about *nine* times as high as that old school-house.

I can't give you an idea of the size of the Republic of Mexico by comparison with my established standard—the school-house—but perhaps I can get at it in another way, by another comparison.

Suppose we select States from the Union, say along the Atlantic seaboard, to make up a country equal in area to Mexico's 750,000 square miles. Commencing away up at Maine, we will take in all the New England States, Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut, then we will add New York, Pennsylvania, Delaware, New Jersey, Maryland, Virginia, West Virginia, Ohio, Michigan, Indiana, Kentucky, Tennessee, Alabama, Georgia, North Carolina, South Carolina and Florida, and the total area is less than that of Mexico. When I figured this out I came to the conclusion that my North American tadpole had an abnormally large tail.

Mexico has a population of between ten and twelve millions (some of the people move around too fast to be counted), of these between three and four millions are Indians.

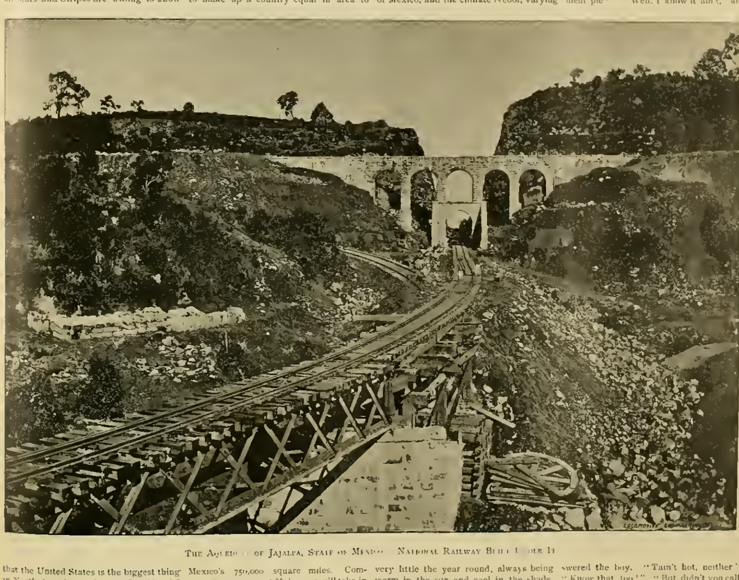
People who have never been to Mexico know a lot of things about the country that are not so. In the first place they think it's a hot country. The coast sections are hot, but three-fourths of the area of Mexico consists of great plateaus, formed by the expansion, or flattening out, of the upper end of the Corderillas, the chain of mountains reaching up from Central America. These plateaus lay from six to eight thousand feet above the level of the Gulf of Mexico, and the climate is cool, varying very little the year round, always being warm in the sun and cool in the shade, and requiring the use of blankets at night, and an overcoat in the evening the year round.

For hundreds of miles the northern end of the Republic is a great, dusty, sage brush desert, even a little worse than the lower fringe of the United States, represented by Texas, New Mexico and Arizona.

The soil on these plains and in these valleys is rich, but there is no water. It has not rained enough to speak of along the northern line of the Mexican National for over three years, and there is a water famine threatened. All over these lands, especially well south, are evidences that once, long ages ago, they were under cultivation and covered by irrigating ditches, aqueducts, etc.

Our people also think that Mexico is a republic like our own, where the men all vote, and the women want to—this is because they have never been to Mexico.

The republic part of it is much like the "hot meat pies" that the boy was lustily calling out on the station platform. A tourist invested in one, took a bite, and called to the boy "Here, boy, this here ain't no meat pie!" "Well, I know it ain't," answered the boy. "Tain't hot, neither" "Know that, too!" "But, didn't you call out 'Hot meat pies?'" asked the victim. "'Course I did, *but that's just the name of 'em!*" A republic is just the name of Mexico. The Czar of Russia rules with no more autocratic power, there is as little voting in Mexico as in Russia, and the bayonet holds the people in subjection just as strictly. And after you have been there a few days, you do not wonder at it, and you are rather glad to see the six white uniformed soldiers that sit in the third-class car of every passenger train, and the well-trained, well-armed dare-devils that stand like statues just twenty feet apart in a line across every station platform as the train rolls in. These are the Rurales—President Diaz' ex-bandit soldiers. When they go



THE AQUEDUCT OF JAJALPA, STATE OF MEXICO—NATIONAL RAILWAY BUILT UNDER IT.

after a man they get h[illegible] [illegible]t they never bring in any prisoners.

Ignorance and superstition have been the curse of the people. The wealth of these people has been piled up in churches and cathedrals for three hundred years, and they simply worked for enough to eat. Eve had on her winter suit compared to some of these people. They have to lay down to cover their nakedness. I actually saw a large gang of men at work filling in a

Typical Mexican Scene. State Road and [illegible] Aqueduct at Queretaro Where Maximilian Was Shot.

bridge, by carrying sacks of earth on their backs and heads, not one of whom had on enough clothes to flag a train if they had all been red.

The Indian population differs from ours in that they all work, men and women alike, and work hard. On the highlands about the City of Mexico the useful land is all owned by a few rich men; a "hacienda" being a farm from 15 to 150 miles square. On this there are towns and churches and people, and they all belong to the owner. The peons are "free," but they cannot leave a place until their debts are paid; they and their children must stay until they are debt-free. As they get 18 cents a day, and have to trade at the owner's store, and support families, they remain slaves forever. When a few own the land, the many are slaves to them in any country. Land is as necessary to the life of every individual as air, and a monopoly of one is as big a "cinch" as the other.

The Indian people of Mexico are very industrious and ingenious; they make many artistic articles that in any country but theirs would bring very high prices.

There is no "season" in the country except the "rainy" and the "dry." It rains every day in the high lands from June until September. But crops are put in any time the ground is ready. It is no uncommon thing to see ripe grain in one field and planting in the next.

The country people are as primitive as they were three hundred years ago. They plow with oxen and a crooked stick. They use carts made entirely of wood, not even a nail in them. They cut grain with sickles, and thrash it out by driving oxen or mules over it. Everywhere you can see "threshing machines." A brick wall about 3 feet high, in the form of a circle, with an opening for entrance and a brick floor. In this they place a layer of grain and drive in their animals. When threshed out they pitch out the straw, winnowing the grain by pouring it back and forth in the wind.

On some ranches you can see American plows; but the peons always saw off one handle to make them like the old wooden ones.

Of course, as the altitude varies the climate varies, so that Mexico can and does raise a greater variety of products than any country in the world. In the neighborhood of Mexico City they raise wheat equal to that of Minnesota, but within eight hours' ride by rail you reach a climate hot enough to raise coffee, bananas, vanilla bean and a thousand other tropical fruits.

Mexico has many rich mines of almost everything except gold and coin—two things she most needs. Their silver dollar has more intrinsic value than ours; yet go to a money-changer there and lay down a Yankee silver dollar and he will give you two of his "dobie" dollars and make seven cents on you at that. This is because ours has a gold backing, and theirs stands on its own bottom. The rate of exchange is very nice for travelers. I got my breakfast, and laid down a United States $10 bill receiving $19.40 in change. But it is hard for Americans working there who have to send money home, as they must pay two for one for it. This also prevents the roads from buying supplies of us.

A first class coal mine would be worth millions in Mexico. Coal is brought to Vera Cruz from Wales, and the price at that city ranges from $4.50 to $11 per ton. The railroads would be about the only buyers, however, as the people never use fires in their houses for heat, and cook with charcoal. Most of the roads are burning wood.

But I started to write about the railroads, and here I am wandering off on another trail. I'll follow up the roads just as I saw them, and try and stick to the subject.

National Railway Entrance to the Baranca of Tres Piños (Three Pines).

THE NATIONAL MEXICANO

is the shortest route between the States and the capital of Mexico, it is only 840 miles via this line, while from El Paso to the city via the Central it is 1,224. This difference is not in a more direct line, but because it starts farther down.

The National is a three-foot gauge road, built much on the plan of the Denver & Rio Grande. It is in pretty good physical condition, but its gauge, it seems to me, is against it, certainly the tourist business would be better if "Raymond" and other special cars could be taken over it, while an interchange traffic would be possible. Yet freight has to be handled at the line, anyway, on account of the customs, and the Central and the Mexican roads will not let their cars go off their line for some reason or other.

There is quite a system of narrow-gauge roads in the country: the National reaching to the city, the Interoceanic from there to Vera Cruz, and the Southern from Pueblo south into the hot country at Oaxaca.

This road was built under a concession granted by the government, and after 99 years will be Federal property. It is 1,232 miles long, counting in the 162 miles of the Texas-Mexican, which is in Texas.

For some reason unknown to the writer the main shops were located at Laredo, Texas, which makes many complications. The Mexican officials will not allow engines to be taken across the International bridge except at certain hours, and the regular road engines, both freight and passenger, are hauled from Nuevo (new) Laredo, Mex., across to the shop for repairs, wiping, wash-out, etc., and back again *dead*.

Laredo, Tex., is a straggling half-Mexican town, hot and dusty to desperation. The shops are pretty well out, and the electric car line runs only one car—it's quicker to walk.

There are very good shops here. The buildings are of brick and stone, fairly well supplied with tools, and in decent order, but it is awfully dull, and men are scarce in the shops.

Mr. Thos. Milan, the superintendent of motive power, spent the best part of a day with me in these shops. Mr. Milan has four big wrinkles on his brow caused by wondering what they are going to do about water. The drought has caused the surface pools, etc., to become especially vile and leaky fireboxes and flues are the order of the day.

Out back of the shop there are a dozen or more fireboxes, cut out because of grooving and pitting, and they had run hardly long enough to get used to the job. They have a small independent shop devoted entirely to flue work, a new set lasting from 90 to 150 days.

Some brand new compounds run out of here, and every stay bolt in their side sheets was leaking, but I opine this was not all water, however that may be, the water is certainly villainous.

Mr. Jas. Farrell is division master mechanic here, but was away at the time of my visit. Mr. R. B. Small (a brother of the Sup't of M. P. of the Southern Pacific and of the N. Y. R. & P.) is general foreman.

They have quite extensive car shops, and do a lot of work. The climate is particularly hard on soft wood and on paint; they have been trying an oil paint on coaches without varnishing, but it was not a success. They are now trying a rubber paint for the same purpose.

First, second and third-class cars are used, the majority of well-to-do people traveling second class, men, women and children smoke in all cars—and everywhere else. The body of a Pullman car is the only place in Mexico where you can not smoke.

city. They always have a wood-passer, who they hire themselves for a very small sum; these boys sooner or later make firemen, and they are not bad ones. The firemen almost always do the pumping, and will shut off the injector whenever they put in a fire, as they have the door open some time; this done they jump for the squirt. They keep a good level in the glass, and take great pains to do it right.

The native fireman (if he is not hungry) is very independent, and discharging one has no effect whatever on the others. When they "get funny" or neglect their business, they are laid off anywhere from six to eight months. They don't care at first, until their money is gone, then they go hungry until their time is up, and will usually saw wood and keep clean engines for a year.

Fuel and supplies are very expensive, and a close account is kept of everything. For some time they have given a monthly premium on each division of $25 for the engineer and $10 for the fireman who show the best performance sheet, have run the most miles for the least money, counting everything, fuel, oil, supplies and repairs. The crews do a great deal of running repairs to keep it from being charged up to their engines, and also take care of oil and fuel. When the plan was first introduced, the running expenses fell down on an average of $1,500 a division.

In Supt. J. N. Galbraith I found an old Rio Grande dispatcher who was at the key and remembered the time the South Park got on my time and got hit, way back in '82.

Here, also, I fell in with Traveling Engineer I. M. Hutchinson, who acted as guide and interpreter for me from Laredo south to San Miguel, some 586 miles, and it's well he did, for alone I should have missed many interesting points, and perhaps gone hungry, for I could not talk the language of the country to any alarming extent.

One thing that fools you at first is the mile-posts, they are so close together. They use kilometers (about ⅝ of a mile). The first post I noticed after leaving Laredo was marked 1,339 and scared me for a minute; it's 1,351.4 kilos from Laredo to Mexico City, but its only 840.4 miles in English.

Our first stop was at Monterey, 167 miles south, the country between U. S. territory and this quaint, historical old city is a desert, and one constantly wonders how anybody ever got across it.

Monterey lays on the eastern slope of a little range of mountains, has a very nice climate, is fairly clean, and was for many years the chief city of the north, being the supply point (before the days of railroads) of the mining States west of it. The bishop's palace is a striking edifice on a high hill. It was here that Gen. Taylor's troops won the first victory of the Mexican war in 1846. One keeps wondering how in the world they ever marched from Matamoros across that 200-mile desert and got there in fighting trim.

The National have no shops here, but do the work out of doors. They have wash-out facilities and a few hand tools. Foreman Bartlett was in charge.

THE MONTEREY & MEXICAN GULF

shops and headquarters are here, they have a fine depot and yards, pretty good shops are under construction, but at present the work is all done in a roundhouse. Mr. Frank Barrow is master mechanic.

The road has pretty good looking power—all Baldwin and Roger ten-wheelers—these look as engines do that run some time without general repairs and stand out of doors.

Great attention is paid here, as on every other Mexican road, to blow-off cocks. There are always three of them, and they must be so built as to admit of handling while running. It's the first thing a master mechanic shows, and they have a different kind on each road.

LAKE PATZCUARO, STATE OF MICHOACAN. HEWN TIES AND BRIDGE TIMBERS FOR NATIONAL ROAD ON MEXICAN CARRETAS.

The later build of freight cars are mostly 40,000-pound cars, having M. C. B. coupler, straight air, and journals 4x7½ inches, and an exceptionally heavy truck. They like the M. C. B. coupler, because the natives can not steal anything from it. When a car is left at a station on this road, they take off the links and pins and the air hose from each end, else there would be none when they came for it. This requires the carrying of a lot of links and pins on all freight trains and a pile of hose. They are stingy and short-sighted about the hose, as only enough to equip ten cars is allowed to a freight train, and they often take from twenty to forty cars down a hill, run too fast and flatten lots of wheels that would not be hurt if all wheels were getting their share of the braking.

Labor is very cheap, and hands can be had for fifty cents a day—and that's all they are worth. This allows some things to be done well, however, as there is little excuse for not wiping engines when labor is so cheap.

This road has a very large number of classes of engines for a road so young. There are classes down to "P"—sixteen kinds is a good many.

They have a class of consolidation engines with the firebox back of the frames that make an excellent narrow gauge model, especially where there is bad water. The box is nearly square, can be made deeper, has a free ash-pan, the mud-ring can be calked, and the firebox be removed without disturbing the head or shell of the boiler. Their only fault is that there is nothing but the long draw-bar between the engine and tank, and unless the holes in the bar are kept pretty well up to gauge the tank rides very hard. Another class have the same boiler and a long draw-bar, but a light slab frame extends back under the firebox, and a wedge can be used between the engine and tank.

Mr. Milan has a very good plan in that he has one shop repair and overhaul, as much as possible, one class of engines. They rebuild most of the freight consolidations at Laredo, while the shops at San Luis Potosi rebuild nothing but ten-wheelers.

They burn wood here, mostly mesquite, and not very good wood either.

Engineers are paid by the day. They are, with one or two exceptions, American. The firemen are all natives; they get $2 per day here and $2.50 out of the

OCOYOACAC, STATE OF MEXICO, ON NATIONAL RAILWAY, AN INDIAN TOWN NEAR TOLUCA.

This is one of the newest roads in Mexico, and is yet in the "grub-stake" period of its existence. The men for the most part claim to be only staying until something else shows up, or until they get in a month's pay; business is dull. I did not go over the road, as I expected to see the Gulf further south. The main line runs through Monterey, from Geronimo Trevino, on the Mexican International, southeast to Tampico, the only good harbor on the Gulf coast. It would do a big business if it were not that the Mexican Central has a line from Tampico to their main line, striking all the important points in the country that formerly sought an outlet through Monterey.

But let's get back to

THE NATIONAL AGAIN.

It's sixty-eight hilly miles from Monterey to Saltillo, our next stop. This is a city of something like 20,000 people, has the regulation plaza, cathedral, and a dozen or so of churches.

The road has a roundhouse, or running shed, and a few hand tools. Jas. Tobin, the M. M. takes life as comfortably as he can, and does all the work he can. The eating-house here is kept by a Chinaman, as are most of them in Northern Mexico, but a very pleasant change was made to Mr. Tobin's house, where I tried my best to put away enough to last me *past* the next Chinaman. We stayed over night here and took an early start the next morning. Seven miles out the train runs across the old battle-field of Buena Vista, where Taylor's handful of men, with a loss of 750, killed 2,000 Mexicans and put the kibosh on Mr. Santa Anna. Some of the old earthworks are still standing. The train climbs all the time over a barren, dusty waste of country, sparsely peopled, and looking as dry as a prohibition town.

We got dinner at Catorce. The station is on a desolate plain, but a little mining road runs some twenty miles up the mountain, away up at the top of which, above timber line, can be seen the famous mining town of Catorce, where they have mined silver in paying quantity since the days of Montezuma.

Not far from Catorce, the line crosses the tropic of Cancer. A halt is made here just to let people know where they are, a large monument with a hand pointing east and another west marks the spot. The monument was erected by Supt. of M. P. Milan when he was superintendent of this division.

It's 235 miles from Saltillo to the interesting old city of

SAN LUIS POTOSI

If I had not started in to talk railroad alone, I'd be tempted to tell you something about this city, its fine churches, new theater and other buildings, which show what wonderful masons these people are, the wells in the plaza, with old-fashioned sweeps, from which a crowd of sandaled peons are carrying water, etc. It was here that the church bells got so numerous and noisy that I could not sleep, though there is an ordinance against ringing some of them and one to prevent certain ringings altogether. I'm sure that they rang all the time before that.

It was here that I first noticed little red lanterns hanging out of the grated windows to keep away pneumonia and other diseases. It was here I saw the first funeral—that of a babe, the little red coffin covered with flowers, was carried on the head of the father, a dozen people followed him. The cover was tied on, which called for an explanation—the little coffin was rented. I afterwards saw children's funerals, where the corpse was simply laid on a board and covered with flowers, the whole carried on the head of a man. There are many gardens and many flowers around the city.

The National has a fine stone depot here and nice little shops. All the power is ten wheeled, freight and passenger. Mr. Fred. Schneider is M. M. here and has the shops in very nice shape. Here, it seems to me, would have been the proper location for the main shops.

I met more men here that I had known "away back yonder," and had a very pleasant stay of twenty-four hours.

Here also are the shops of the Central for their Tampico division. Master Mechanic Haynes was away when I called, but I wandered through the shops for awhile. They have good buildings and a great many good tools. Out under a shed two natives were firing a large boiler for all they were worth. I noticed it was a water-tube affair and stopped to look at it. The steam-gauge was so black you could not see the hand, and one of the men explained that it was "no wano" (no good), it was out of order, and had been for a long time.

In the roundhouse, one of Mr. Johnstone's double enders was all torn to pieces. They have been breaking the side levers, and new ones of cast steel are being built for them.

These shops are good stone ones, they are surrounded by a stone wall and one side is lined with quarters for employés and their families.

Against this wall is piled about 200 tons of scrap—there is no market for scrap in this country, it's too far to mills.

At San Miguel, 110 miles further south, Mr. Hutchinson's duties required that he head north again, and it was with a very lonesome feeling, and a due appreciation of his help and kindness that I bid him good-bye and got on the train again, but the minute the conductor opened the door I was at home—it was Bill Law, and didn't I pull Bill Law out of Leadville twelve years ago? Bill and I gossiped until we reached

ACAMBARO.

This is a division terminal, and Master Mechanic Jacobs was waiting for me. Mr. Jacobs was for twelve years master mechanic of the Arroyo road in Peru, he has been in Mexico several years, can talk Spanish better than a native, and has a large fund of reminiscences. I slept well, and in the morning visited the shops—they are all alike, more or less, and I'm not going to describe any more of them. We walked through the queer old town, visited the magnificent old stone bridge, built by the Spaniards, how long ago no one seems to know within a hundred years, the bridge is a splendid piece of stonework, and its solid arches look as if they intended to stay right where they were for a few hundred years longer.

For more than a hundred miles south the road travels over a mountainous country, full of broad and plateaus that bear evidence of former cultivation, past some rich and well cultivated valleys, and at last enters the thriving city of Toluca, capital of the little State of Mexico. Toluca, like Milwaukee, is famous for its beer. Ed. Knapp said so and Knapp is general foreman and takes subscriptions for the LOCOMOTIVE ENGINEERING, and ought to know. The city is on the edge of a beautiful, well cultivated valley, the prettiest sight I had yet seen. The train was crowded from here into the city.

At Toluca I met Dick Bolby. Dick and I fired together in '80: Dick fired the "33," the first engine that went into Leadville, I fired the "30." If he had not left the road about this time and gone to Mexico, I am sure I should have left and gone on a ranch—for we were rivals.

I had a record as an all-round liar when I came there, but Dick wore the Rio Grande belt, and it was neck-and-neck with us for awhile. Dick is Grand Past-Master of the Ananias Club now, and to prove his claim, I'll tell you a bear story of his (in another part of the paper) that will forever settle all disputes in his favor.

From Toluca to Mexico the scenery is magnificent. We cross a beautiful valley and then a mountain, grades of 211 feet, where you look down on that valley as on a map. On the hill engines I ran on to more old friends in Tabor, King and Zimmerman. J. F. Roberts was a Denver man, and from his engine I saw the wonderful cultivated slopes of the mountain on the southern side, for from the summit to the city it's one terraced field after another of maguey plant (century plant) from which the great national drink, "pulque," is made.

Just out of the city we passed an engine, dead—soft plug blown out. On her was Ed. Rinckel, a first-class, broad-gauge fellow on a narrow-gauge road. I got acquainted with Rinckel at the B. L. E. Convention, at Atlanta two years ago. "Say," said he, "I'll be in by 11 o'clock, and I'll lay off a week and go around with you"—and he did.

To him I owe much of the pleasure and interest of the trip south of the city and

SPRINGS RETIRED AS NOT RUNNING GUARANTEED TIME. NOTE WEAR OF HANGERS, DRIVERS, ETC.

OFFICERS' CAR, LEHIGH VALLEY RAILROAD.

in and around it. If he ever comes to New York I shall take an afternoon off and show him the razzle-dazzle at Coney Island

Hold still, now, till I just say that the National has another shop, a little better than the average, at the City of Mexico, in charge of Master Mechanic L. H Sherman, that the passenger trains are all hauled by Baldwin compound consolidation engines; that they do better than any compounds I know of, the service being slow and hard, and that they are having trouble to make their injectors take up the overflow after two-thirds of the water is out of the tank (pressure 180), and I won't say a word about the city or any other road until next month—honest

J. A. H.

Dick Bolby's Bear Story.

The American colony gathered on the sunny side of the Mexican roundhouse and told lies about fast runs they had made and what they had told the superintendent and the general manager, until Dick Bolby dropped in with a happy smile on his classic features—just such a smile as a fellow always has when he comes in from a successful trout fishing or tiger hunt Dick had been hunting jack rabbits up on the divide.

"Well, Dick, old socks," said Grimsby, "how many John rabbits did ye git?"

"Thirty-two jacks," said Dick, loading his cob pipe, "four mountain sheep and a cinnamon bear"

"Bear, hey? Well, that's more like. Did he make a fight?"

"Well, considerin'," said Dick, thoughtfully, "he did—not as I let him get to me but a better studdy o' bearology and bear temper I never had.

"You see, I'd herd lots about bears and what they could and would do when wounded, but I didn't believe much of it. I was thinkin' o' bear when I come out of a little sage brush patch into an opening, and there was a big he cinnamon.

"Well, sir, he wasn't long in risin' to his business. He stood up on his hind legs and got hisself into a John L. position. I jest thought to myself, 'Old man, I'll see if you fellers kin perform as they say when you're hurt and not killed.' So I pulls up my Winchester, and jest clipped off three toes of his front paw.

"Well, sir, it was sort o' terrifying the way that critter did. He let one big yell out of hisself, jumped clear out into that opening, licked his hurt paw, and jest nacherly *lashed his sides with his tail*!"

None of the boys had killed bear, nor even seen 'em, so Dick was a hero for over two months, until a dago come to town with a dancing bear and told "Zim" and "Blondy Rinckel" that "barra navvar gotta tala, verra shorta holda." Then they went and made fun of Bolby, pretending they knew it all the time

Something of a Flat Spot.

General Superintendent Bradley, of the West Shore, tells an amusing story of his early railroad life.

It was out in Western New York, and in the days of iron tire.

Old Judd Morrell was running an old pelter that had been shimmed and flattened until she rode like a tin peddler's wagon on a corduroy road. The superintendent, who is now vice-president of the C. & E. I., got on the engine one day and sat down on the cushionless seat for a ride

When they got to going pretty lively the engineer stood on tip-toe to lessen the jar, the fireman went out in the tank and the superintendent's hat danced around on his head like a green boy on a trotting horse, finally, he leaned over toward old Judd and said

"Judson, isn't this track pretty rough, or has she got a flat spot in her tire? Don't seem as if her wheels was round?"

"Round," yelled Morrell, "Why, sir, her wheels ain't no nearer round than the State of New Hampshire!"

An Expert in the Business.

"A good many summers ago," remarked McGiane, "when I was firing between Troy and Albany, there was a fireman on the road noted for his expert acquisitiveness of other people's property.

"If there was anything in sight that he wanted it seemed to kinder come to him.

"Complaints had reached the office time and again that articles had been missed just after the train had left on which this firesy was employed.

"They changed conductors, brakesmen, engineers and everybody else, until the trouble was finally laid to the door of the fireman, but he was so good-natured and free-hearted that the only punishment was a reprimand.

"Cases occurred several times, until the reputation of this particular fireman for honesty was at low ebb at headquarters. One morning the superintendent was reading a complaint of a boarding-house lady, that the fireman of the '93' had stolen a large, red, rocking-chair off her porch, when a conductor came in.

"The con. was an old-timer, and had been saving up his money to buy a farm. He and the super had 'broke' together way back in the '40's, and he had great faith in the old man's judgment.

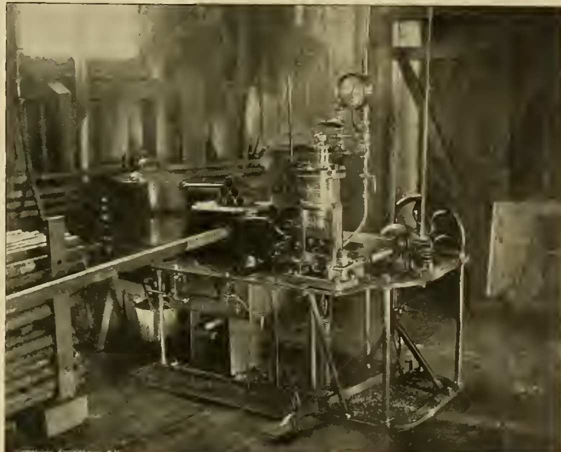
"'Well, Jim,' says he, 'I've got $3,000 together now. I want that farm, where do you think I could get one that would suit?'

"'Well, lemme see,' said the super, thoughtfully, 'ah yes, I have it—you go to that d—m fireman on the '93' and he'll steal you one.'"

Vail & Cummings' Welding Machine.

The apparatus shown herewith is in use in the shops of the Western New York & Pennsylvania Mr Vail, writing about the apparatus, says

"I attach photograph showing Vail & Cummings' combined boiler tube welding and swaging apparatus. With this machine 250 2-inch or 2¼-inch boiler tubes can be welded and swaged in ten hours without hurrying. The water tank shown in the left of the print is connected to a water mandrel by a circulating pipe, and by its use pieces as short as 2½ inches can be welded. The furnace is constructed of firebrick, and its fuel is fed in from the side. The swaging apparatus is operated by compressed air, and the dies can be adjusted to suit any size of tubes used in locomotives.



VAIL & CUMMINGS' FLUE WELDING MACHINE.

Is this an Intelligence Office to Furnish Help in Case of a Strike?

Something like a year ago we received a letter from a young man anxious to go firing, he wanted pointers about how and where to get on the road.

We receive a large number of letters of this character, and always answer by telling the applicant to seek employment on a home road.

Our correspondent tried to get on firing, but the times being hard he failed, and kept to work at his trade, that of carpenter.

He recently wrote us, stating his experience and inclosing a circular letter from the National Railway Employees' Exchange (whatever that may be) which we reproduce below.

We have been hearing for some time that there was a bureau in Chicago that made a business of listing men for the purpose of supplying men to roads in case of a strike Perhaps this is the concern.

They seem willing to take (at regular rates) firemen without any experience whatever, and put them to work, if they are as particular about engineers, the men furnished by the Exchange must be very reliable (?)

Of course, all the riff-raff and no-account engineers in the country will be "on the list." God help the passengers on the road equipped with these ready-made men.

Too little care is exercised now by railroad officers in the selection of men for positions of trust and responsibility on engines and trains, and we should be afraid to ride on a road whose men were gathered from the four corners of the earth by an exchange for a commission. We have not investigated this new supply depot, but just on the face of it it looks like a mighty good thing for men and railroads to let alone.

National Railway Employees' Exchange.
Secretary's Office, 359 West Congress Street

CHICAGO, ILL., Feb 12, 1894.

DEAR SIR—In reply to yours of .. inst., inclosed please find blank application for position as locomotive fireman, which please fill out in detail and return to this office at once, together with fifty cents for membership, when your application will be filed and placed at the disposal of the proper official of any railroad company in the United States needing or about to need men. During the past six months a large number of companies have greatly reduced the number of engine and train crews in service on account of slack business, so that even a slight increase in business calls for the re-employment of former employees or of new men, and other emergencies are likely to occur any day, when one or perhaps several of the larger companies may require the services of a large number of experienced railroad men in a short space of time. All this you will get the direct advantage of through the Exchange being in communication with, and having the sanction of general managers, superintendents, master mechanics and train masters throughout the country.

Your application, together with our recommendation, will thus be on file and receive attention in advance of those who depend upon newspapers or letters to officials for their information

If you feel yourself to be deficient in any way on machinery, air-brakes, rules or time card—if there are any little quirks you want straightened out—let us know at once, and our examiner will send you our blank forms of examination, covering all the points called for by the leading railroads.

When satisfied as to your ability, character and habits, we will do all in our power to obtain for you a permanent position and advancement as you merit it, and will send you a certificate entitling you to all the benefits and privileges of the National Railway Employees' Exchange, which we know will be of great benefit to you with railroad companies.

Expecting in return for our services—in addition to membership fee, which hardly covers the expense of placing your application properly—a sum equal to 3% (three per cent) of your second month's salary. All applications will receive complete attention in the order of receipt, and you will be kept fully advised.

Yours, very respectfully,

H. C. CASS,

Secretary.

Reforming the Counterbalance Practice of a Big Road.

Most roads have had more or less trouble with the counterbalance question, but few of them have devised a plan to remedy defects and put it into operation.

On the Louisville & Nashville a decided step has been made, and every engine that goes into the shops has every wheel and rod and piston and crosshead weighed and the counterbalances readjusted to give the best results.

A difference of over 100 pounds per wheel has been found between what counterweight was used and what ought to be used, and a difference in counterweight of 100 pounds has been found on wheels on the same axle.

Fig. 1 shows the method employed to weigh rods. The connections are held up on the edge of square iron bars, supported on cast-iron standards as shown, each connection is weighed and the weight noted.

The method of weighing the wheels is shown in Fig. 6. The axle is supported on level horses, a straight edge is clamped across the wheel as shown, and an adjustable standard placed between it and the scale platform. The method of figuring is explained below (taken from notations on the blue print).

In almost every case it has been found necessary to add weight, and the way this is done is shown in Figs. 7, 8 and 9. A plate is fastened on to the front of the counterbalance weights, and this is done in such a way as to relieve the rivets or bolts employed of the load. The extra weights have bosses cast on them and these enter and fit holes bored in the old counterweights, the rivet merely holds the two parts together, the bosses carrying the weights.

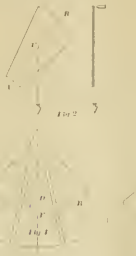
Fig. 10 shows a special tool employed to form and finish the bosses, and Fig. 11 a tool to bore the holes in the wheel.

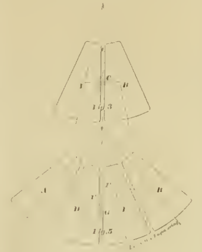
The following directions and example show the mode of procedure in testing and adjusting counterbalances:

TO DETERMINE THE WEIGHT TO BE BALANCED.

Weigh side rods and main rod as indicated in Fig. 1, noting the weight due to rods for each separate pin. To the weight thus found for the main pin add the weight of back end of main rod. Weigh piston, piston-rod, and crosshead complete, and to this weight add the weight of front end of main rod; this will give complete weight of reciprocating parts. Take two-thirds (⅔) of this weight and divide it by the number of drivers on a side, and add the quotient to the weight on each pin. This will give the revolving weight on the pins to be balanced in the counterweights.

To get the proper weight in the counterbalance we must know the center of gravity of these counterbalances. To find this cut a thin wooden template the exact size of the counterbalance, and scribe a center line as *A B* in Fig. 2, then hang it by one corner so that it will swing freely, and drop a plumb line from the point of support; where this line crosses the center line will be the center of gravity sought, as *C* in Fig. 2. If the counterbalances are solid, this method will apply for any sized template. If separate find the center of gravity for one section. The center of gravity for the group will then depend upon the number in the group.





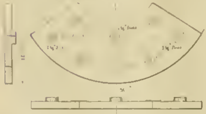


Fig. 7

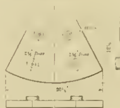


Fig. 8

If two sections, describe a circle from the center of the axle through the center of gravity of each, as *A B* in Fig. 3, then connect the two centers of gravity by a chord, and where this chord crosses the center line between the two sections, as at *C*, Fig. 3, will be the center of gravity of the group.

If three sections, describe a circle from the center of the axle through the center of gravity of each, as *A B* in Fig. 4, connect *A* and *B* by a chord crossing the center line of the middle section at *D*, lay off one-third of *D E*, and the point, *C*, found will be the center of gravity of the group.

If four sections, describe a circle from the center of the axle through the center of gravity of each segment, connect the extreme centers by a straight line, as *A B*, Fig. 5, then connect the remaining centers by another line, as *D E*. These will cut the center line of the group at *F* and *G*, then one-half the distance, *F G*, will give the center of gravity, *C*, of the group.

To test a pair of wheels as to their balance proceed as follows:

A pair of trestles are provided, on the top of each of which is placed a smooth iron surface, such as a pair of old engine guides, these trestles are made so that they can be leveled in both directions. The pair of wheels are then placed upon these trestles and leveled up in both directions, and are then ready to weigh. Get the side which is to be weighed, in the position as shown in Fig. 6, so that the line through the centers of the pin and axle shall be perfectly horizontal or level, and by means of the straight edge clamped to the wheel as shown, the overhanging weight of the counterbalance can be determined by using a prop as shown; this should be placed under the straight edge at a distance three times the distance of the center of crank-pin from center of axle. Then the weight on scales multiplied by three will give the weight acting against the weight on the pin at an equal distance from the center of axle.

This is the weight which should equal the weight on the pin after adding its share of the weight of the reciprocating parts.

To find the actual weight of metal to be added to or deducted from the counterbalance, multiply the difference between the crank-pin weight and the counterbalance weight, as found at crank-pin line, by the distance of the crank from center of axle, and divide the product by the distance of the center of gravity from the center of axle. This will give the actual weight of metal necessary to add to or deduct from the counterbalance. This weight must then be distributed equally over the surface of the counterbalance, or if deducted from it by counterboring from inside of counterweights, due allowance should be made to retain center of gravity.

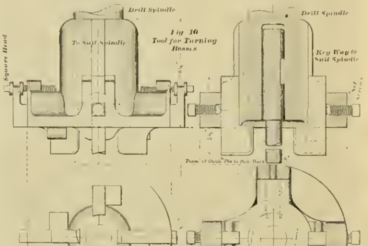
Figs. 7 and 8 show preferable mode of applying extra plates.

Fig. 9 shows mode of riveting extra plates on to wheel by passing rivet through countersunk lug on plate.

Fig. 10 shows tool head for finishing lugs on plate.

Fig. 11 shows tool for countersinking recess in wheel for lug.

Order all counterbalances through the office of superintendent of machinery, giving outline of blocks needed, weights desired and thickness that can be applied, always allowing at least seven-sixteenths



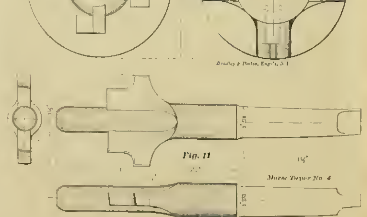


Fig. 11

(7/16) of an inch between blocks and side rods.

EXAMPLE. *Correcting Counterbalance of 20 x 24 Ten-Wheeler — Diameter of Drivers 60 inches.*

(Dimensions and Weights are for one side only.)

WEIGHT OF RODS.

	Lbs.
Front end main rod	182
Back end main rod	300
Back end front side rod	125
Weight of side rods on main pin	310
Back end back side rod	125

WEIGHT OF RECIPROCATING PARTS.

Piston and rod	350
Crosshead	330
Front end main rod	182
Total	862

Two-thirds of reciprocating weight = 574 lbs., 574 ÷ number of drivers on a side (3) = 191 lbs. This to be added to weight of rods on each pin.

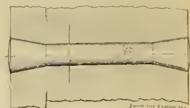


Fig. 9

Distance of center of gravity from center of axle found to be 21 inches.

MAIN WHEEL.

	Lbs.
Weight of back end main rod	300
Weight of side rods on main pin	310
Total	610
Weight of reciprocating parts per pin	191
Weight to be balanced	801
Weight on scales at 36 inches	240
	3
Equivalent weight at 12 inches	720
Weight on pin to be balanced	801
Value of counterweight at 12 inches	720
Deficit	81

BACK AND FRONT WHEELS.

(In this case weight on both front and back pins was the same.)

	Lbs.
Weight of rods on pin	12[illegible]
Weight of reciprocating parts per pin	191
Weight to be balanced	31[illegible]
Weight on scales at 36 inches	22[illegible]
	3
Equivalent weight at 12 inches	67[illegible]

	Lbs.
Value of counterweight at 12 inches .	675
Weight on pin to be balanced	316
Surplus......	359

The actual weight of material to be deducted from counterbalance to be equivalent to 359 lbs., at 12 inches from center of axle is found by multiplying the 359 by 12 and dividing by the distance of the center of gravity from the center of axle, which distance has been found to be 21 inches.

$359 \times 12 \div 21 = 205$ lbs.

We find the area to be 390 square inches, and as one-quarter of the area will give the weight per inch of thickness, we have $390 \div 4 = 97\frac{1}{2}$ lbs. per inch of thickness, then $205 \div 97\frac{1}{2} = 2.1$ inches to be deducted.

Jim Blinkers' Failing.

BY R. E. MARKS.

Jim Blinkers was a peculiar chap, a good-natured fellow as ever lived, and was always willing to help a friend out of a scrape, but he had one great failing, at least so the men all said, for Blinkers would lie like a trooper at times, but he had his reasons. He had been foreman for years, had seen as many as eight superintendents over him, and Blinkers said, on the quiet to his few bosom friends, that every one had his pet scheme which cost the company more than his salary every year, and this was the real reason of Blinkers' rivalry with Ananias—that chap with corrugated teeth which twisted the truth into a lie before his mouth shot off.

If Blinkers had told the solemn, baldheaded truth on every occasion he wouldn't have held his job six months, and Blinkers knew it. And knowing that he would never get the super's place offered to him, on account of lacking the "x y z cosine angle" in his education, he just froze to his job like an icicle to an iceberg, and the cement used to stick was telling just what the super wanted to know.

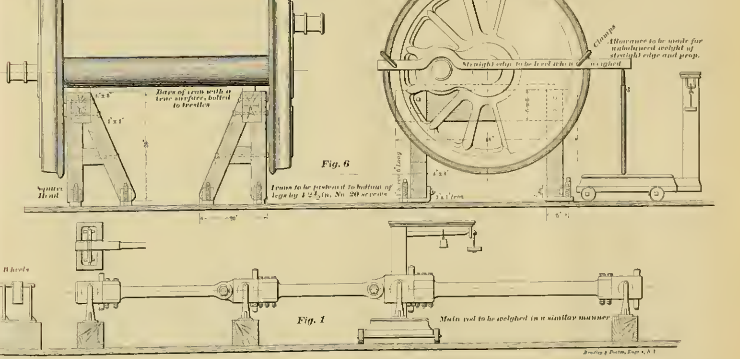
But the last man gave him the hardest task of any, and Blinkers hadn't told the truth to his knowlege for three years at the time he unfolded his tale to me, his father confessor, begged forgiveness, and promised to reform just as soon as the super got fired and a new one came. "You see," said Blinkers, as he glanced around to see that Tomkins (the super) wasn't in sight, "Tomkins got a great scheme for a blowing engine or air pump, making it compounded, and making one valve and a piston valve at that, do all the work of steam distribution, cutting the air into proper sized chunks and firing it into the receivers, and sometimes, though this wasn't intended, it had to chew up cinders which found their way into it.

"You can imagine what kind of a valve this would make, big as a barrel, and openings enough in the ports or shell to make it do for a collender such as your wife uses, or a coal screen for pea coal, and naturally enough this gave trouble sometimes.

"But the first blower that was turned out was 'perfect,' gave cards like a Corliss engine, saved 67.3% of fuel, 73.4% of oil (for lubrication), and added 43.1% to the compressivity of the air, or about those figures, tested by H. G. Nopants, M. E. But somehow or other things didn't go right; the crank disk either wasn't balanced or else it was balanced too much, came to me and told me of the trouble he had, I was 'surprised,' couldn't understand it at all, and told them that *they had better not, either*, and to say air was steam, and steam air if Tomkins wanted them to, and he generally did. But when the blowers would be back for overhauling the questions would come in, and the most skillful liar in America couldn't answer them all without making a fool of himself; but it was either be a fool or lose the job—and I kept the job.

"Men would say 'Blinkers, what ails this blower, why should she be sent back from Kalamazoo? I'd like to have what the freight cost.' 'Main-bearing thumps and crosshead wants lining up, and they didn't have any tools.' 'Better buy a machine shop than pay freight, I should think,' they would say, and then I would laugh at them and tell them 'They ought to study machine shop economy,' but every apprentice in the shop knew I was lying. Send a 40-ton blower 2,000 miles to have a main-bearing fixed or crank disk balanced, or crosshead lined up—did ever a man try to the wrong oil, forgot to cross himself and tip his hat as he came in the room, or some other good 'mechanical' excuse, designed by Tomkins, or on lines and formulas laid down in the drawing-room. Well, the last one that came back to be 'doctored' caused the same talk, and one of my boys asked me 'what ailed the beauty?' and after mentally thinking which part of her would be least likely to be seen, I said, 'the frame cracked between the valve and the cylinders,' and gave him a job at the other end of the shop—he is too inquisitive and investigating when there is something you don't want him to know.

"Next day I was sent out to see another, and I'll be whipped if they didn't put that boy of mine to taking her apart, and 'twas too late to mend matters when I got back. He began to quote to me about Solomon's saying regarding the truthfulness of men, which was, to say the least, applicable to the case, but then I couldn't tell him so. But I have lied so much since Tomkins sprung his scheme on us



L. & N. METHOD OF CORRECTING COUNTERBALANCE WEIGHTS.

nobody knew which, but Tomkins knew that could be fixed all right, and went on building more of 'em. But blower No. 1 didn't quite suit, even if it was 'perfect,' the foundations wouldn't stand the shake, and something had to be done, and as Tomkins wasn't able to get the shake out of her in a little over a year's trial, the owners took her in hand, put on ordinary compressor cylinders and valves, and the first 'perfect' blower ceased to be, but newspapers and medals of award kept the success booming, and orders kept coming in.

"When any one asked Tomkins about the first one being altered, he said 'Prejudice,' looked wise, and walked off, and I had to say 'prejudice' so many times that my wife used to wake me up nights and ask me what I was talkin' about, said I kept talkin' about 'prege' and 'dice,' asked if I had gone mad or taken to gambling. Blowers kept being sent out, men with them, and the men often staid as long as the blowers did, trying to get them to run steady, and keep up the record of the first one; but once in a while a fellow would manage to steal away in the night and come home, hoping to be sent to China before complaints came from the last blower he set up. Some succeeded and some didn't, and when a chap lie under worse conditions? Shades of Cæsar, I'd rather make up a good, decently, respectable lie, than have every boy in the shop think me a —— fool besides.

"We built over a thousand of the grand 'economizers,' saved everything (but lying and profanity) from coal to air, before Tomkins would believe anything ailed the internal arrangement of the animal, and, of course, he didn't hear me say that anything was wrong with the digestive organs. Not that they were diseased, unless it might have been a tape-worm, but they seemed to be too *healthy*, if food *taken* but not *digested*, can be called healthy. The thump and uneven running became too much of a nuisance to be tolerated, and something must be done. But balancing the crank-disk didn't cure the pound, although it helped it somewhat, and after many an attempt to lie to the blowers themselves and make them think they were running all right, Tomkins set to work to improve his 'perfect' blower-valve of three years before.

"We would go to a place and under pretense of balancing the cranks or lining the guides, we would change the ports in the valve seat, chip off here, put on there, according to the latest 'diagram,' and then swear the trouble was in the main bearing, engineer hadn't kept it lined up, had used that I like to talk plain facts to you, just for a change. Seems almost like going to the sea-shore for over Sunday, to be able to talk without inventing lies and excuses about something or other. But after they fire Tomkins I'm going to have a talk with the 'old man,' and see if he hadn't just as soon I'd tell him things straight instead of lying, and after they have paid these bills, I rather guess he won't mind once in a while. But it has been lie or get out, for three years, to say nothing of the other 'supers' with their pet schemes, and two or three of our best 'setting-up men' have walked the plank because they came back and told things as they were."

Jim Blinkers stopped, he had fainted, and I worked over him twenty minutes before he came to. He hadn't told the truth for so long that the strain was too much for him, and for his family's sake I warned him not to do it again, or at least to begin gradually, and he said he would.

Now, you who think this story may be exaggerated, just stop and think if you don't know or haven't met "Jim Blinkers" somewhere on your travels, and if you have, just be easy in your judgment of his shortcomings, for his job depended on it. "Jim Blinkers" are numerous.

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Keeping Air-Brakes in Working Order.

Anyone who has good opportunities for observing the automatic air-brake on freight cars, cannot fail to be struck with the wonderful persistence of the mechanism in performing its functions under crushing neglect, and under conditions that strongly invite failure to operate. That air-brakes should occasionally be found in a defective condition is a matter of course due to reckless neglect; that the most of them should be found doing their work satisfactorily for years without the least attention, is one of the most surprising things developed in the mechanical world. We have frequently met with instances illustrating the wonderful persistence of air-brakes in operating when nearly all other machinery subjected to similar conditions would have been useless. We know of a case where air-brakes had been in use on a small road for five years, and absolutely nothing had ever been done to them. Not a cylinder had been oiled, or an air-pump examined, and yet, the brakes worked fairly well, but this usage is nothing compared with the treatment accorded to air-brakes on many of our freight cars. They go into service, and nothing is done to them until they fail to work. In the meantime, the hose is half the time trailing loose, accumulating all sorts of objectionable matter and the cylinder piston is hammering in the head a great part of the time. The triple-valve is often working in water, and lubricants very rarely reach any of the moving parts. It is phenomenal that air-brakes should perform their functions under this treatment. That they do so, is not an unmixed good, for were it absolutely essential to give them more attention, neglect would not be so commonly afforded.

Railroad companies are not equipping their freight cars so fast as they might be expected to do, considering the approach of the time when the use of these brakes will be compulsory for interstate traffic, but most of the roads have applied air-brakes faster than they have provided facilities for inspecting the brakes and keeping them in order. The leading roads, which depend upon the air-brakes regularly for controlling freight trains, have been forced by grim necessity to organize an air-brake inspecting and repairing force but many roads that have a smaller proportion of air-brakes applied to the cars, have made little or no provision for keeping them in good working order. They depend in a great measure on connecting roads to do the inspecting and repairing. Cars that have to go east of Chicago seldom encounter a yard where testing facilities are provided for air-brakes, and on many of the roads no attention whatever is paid by trainmen to cars with brakes out of order. On Western roads, conductors are required to report cars that have brakes not in working condition. This duty is performed as faithfully as any other duties connected with train operating, and brakes in bad order are by this means identified and repairs are affected as soon as possible. Were a system of this kind in operation on all railroads, there would be less cause for complaint, and it would do much to solve the problem of keeping air-brakes in working order, but there are very few railroad companies which display any practical interest in the matter. There is a prevailing objection to do anything which is to increase the working force in the smallest degree, and on this account the air-brakes which have been applied at so much cost are permitted to lose their real value.

At several of the railroad club meetings, where the care of air-brakes was under discussion suggestions were made to introduce defect cards for air-brakes, which would be filled out by the conductors. This would be a move in the right direction, if it disseminated the understanding that it was the conductor's business to watch the air-brakes closely, and systematically report defects found. It will take a long time to spread this kind of practice over all the roads in the country, and an authoritative beginning cannot be made too soon. The real cause of the prevailing neglect lies with the higher railroad officials. They become prevailed upon to equip a certain portion of their rolling stock with air-brakes, and then their sense of responsibility ceases. They do not reflect that the introduction of this complex mechanism entails new duties. The cars are placed into service to go whither business calls, the men handling the trains are given no instruction about them, and the same set of car repairers, whose skill and knowledge goeth not beyond the changing of an oil-box, are expected to do any repairs required by devices whose interior construction they have no conception of.

The impressing upon trainmen of the knowledge that they are expected to report on the condition of air-brakes will be of great service in the maintenance of brakes, but still greater efforts are needed in several directions. The trainmen ought to be carefully instructed concerning air-brake mechanism, and examined at intervals to testify how far they understand the device. It is a common thing to find air-brakes on cars cut out on the ground that they are inoperative, when all that is wrong is that the slack has been taken up so tightly that sufficient air does not get in on an ordinary application to move the piston.

But increasing the knowledge and responsibility of trainmen concerning air-brakes is only a beginning of the reform necessary. The crying need of the time is the establishing at all interchange points of apparatus for testing the brakes, of men trained to inspect the brakes intelligently, and of others competent to make the repairs with skill and accuracy. When a suggestion of this kind is made, it is immediately rejected on account of the great expense it would involve. We believe that the expense is much less formidable than most railroad men think it is who have not figured upon the cost. The apparatus required consists mostly of piping, which is cheap enough these days. When all they have to inspect are air-brakes, one or two men can go over a great many cars in the course of a day, and their wages are easily saved by the damage their work prevents. One of the most common defects of a triple-valve is that, owing to the presence of dirt, it will not act in making a service stop. It is quick-action or nothing. This quick-action on a single car causes destructive shocks and will, in the course of a run, pull out more draft timbers and damage more couplings than would pay the wages of trained inspectors for a month. This troublesome defect of the triple-valve is one which trainmen are not likely to detect, but it would be readily found out by a trained inspector.

The New York Central has an excellent air-brake inspection plant at Buffalo, which is well worthy of examination by those who are frightened at the cost of establishing and maintaining plants of the kind. The men in charge inspect and repair the air-brakes, and the expense entailed is trifling considering the valuable work done. As the triple-valve is the principal member of the air-brake family which calls for repairs, they keep a supply of perfect triples on hand, and when one on a car is found defective it is taken off and one in good order put in its place. When the inspectors are not engaged examining brakes on cars they devote their time to repairing the triple-valves and other parts which have been found defective.

As has been frequently remarked, the air-brake for freight cars has come to stay. Many roads act as if the putting on of the apparatus was a temporary craze that would soon pass away. Those who act in this way had better pull themselves together and gaze at facts which are accomplished. Then they will be in a proper frame of mind to admit that apparatus and persons of higher quality than those needed for the repairs of draft rigging must be provided to keep air-brakes in good working order.

The M. C. B. & M. M. Conventions.

The railroad mechanical conventions, which will be held at Saratoga, N. Y., this month promise to be among the most interesting and useful meetings that have been held in the history of the Master Car Builders' and Master Mechanics' Associations. It might be supposed that men in charge of railroad rolling stock meeting every year would, in a short time, exhaust the subjects suitable for investigation and discussion, but the progress and changes in this department of the mechanical arts are so great, that new phases are constantly appearing and improved methods coming up which require study, research and discussion. The man who remains away from the conventions for a year or two and pays no attention to the work done is likely to fall so far behind in the march of progress that he becomes an unprofitable officer to his employers. The investigations, reports and discussions contain information that is of great importance to railroad companies, and, the men who digest thoroughly the facts presented are likely to put them to good practical use. While we estimate at their full value the educational importance of reports and discussions, we have always considered that the semi-social intercourse for which the conventions provide opportunities is of great benefit to all concerned. A great many master car builders and master mechanics who attend the conventions find this the only time during the year that they can meet with men engaged in the same occupation, and they avail themselves of this event to exchange personal experiences. In the course of these social talks accounts are given of difficulties encountered and the methods followed to overcome them.

But the most amusing part of these experience meetings is the account of mistakes made. Many a man who was contemplating various improvements, went to the convention and returned satisfied that what he supposed to be improvements were exploded fallacies. When conversing with some brother master mechanic he revealed his purpose, and received in return an account of how utterly worthless the other man had found the things to be. The information brought home from this source alone is of sufficient value to pay the expense of attending these conventions.

The Master Car Builders' Convention has to deal with an extraordinarily wide range of work, no less than fifteen subjects being given out for committees to report upon. They embrace all the most important points concerning the construction and operation of cars, several of them being reports of tests conducted to demonstrate the comparative value of different material. One of the most important of these is the report on "Laboratory Tests of Metal for Brake Shoes." Railroad companies are badly in want of accurate information on this subject. The higher speed of trains is every year putting harder duty upon brake-shoes, and the prevailing cast-iron shoe is entirely inefficient for the work to be done. There is an impression that more durable material is made to last longer at the expense of the wheel tread. There are good reasons for believing that the wear of wheels under the action of hard, tough brake-shoes is not so serious as it is reported to be, and it is to be hoped that the report of the committee will settle this important question.

The only subject of urgent importance which will not be discussed at the Master Car Builders' Convention is the necessity for a standard box-car body. The sentiment in favor of a standard of this kind has been growing so rapidly during the past year that we may expect the subject to be taken up in the near future.

There are ten subjects to be reported upon by the committees of the Master Mechanics' Association, which will, no doubt more than occupy all the time at the disposal of the convention. It is much better and more profitable to have a few subjects thoroughly discussed than to have a great many which must be hurried through for want of time.

Several of the reports are of a kind likely to excite earnest discussion. First among these may be mentioned the report on "Cracking of Back Tube Sheets." This refers to a defect in boiler construction which greatly increases the cost of maintaining boilers. If remedies should be recommended they will certainly deserve adoption, but it is likely that conflicting views may be heard about the disease and its cure. The subject of "Boiler and Fire-box Steel" will be reported on again, and recommendations made for standard specifications and tests. Material for boilers and fire-boxes is a subject which always excites controversy. When it comes up in this convention it is to be hoped that there will be more facts and fewer prejudices aired than there have been in previous discussions. What may be regarded as the final report on "Standard Tests of Locomotives" will be reported on. The subject is in able hands, and will no doubt end in establishing standard methods. A new and important subject, the "Cost of Maintaining Locomotives," will be reported on, which will discuss the comparative cost for repairs of locomotives built in contract shops and those built in railroad shops. This is a subject charged with explosive material, and may lead to racy discussion. Builders of course consider their work first-class, and nearly all master mechanics who build engines in their own shops are prepared to show that their own product is far superior to the purchased article. It will do no harm to bring out facts relating to the subject.

For several years there has been agitation in favor of Saratoga or some other central point as a permanent place of meetings for the associations, and we thought the idea a good one. In the course of a recent tour, when the writer had the opportunity of talking with a great many of the members of both associations, he was surprised to find decided opposition to holding the conventions at one or two places. The members say that attending the conventions is the only time in the year they are given a holiday, and they consider it only fair that they should be given the opportunity to visit different sections of the country. Their will ought to be the law in a matter of this kind.

Weak Car Bolsters.

There is no part of the railroad car so badly in want of improvement as the body bolster. We recently spent the greater part of a day in a very large yard where hundreds of cars belonging to a great diversity of roads were stored. We were searching for the defects which involved the greatest expense for repairs. At first we were inclined to put defective draft appliances at the head, but after prolonged examination, assisted by a highly intelligent car interchange inspector, we concluded to place the inferior body bolster at the head of the causes which keep the car repairer busy.

A peculiarity about a defective body bolster is that it performs its destructive actions in secret. When a badly constructed truck is holding the wheels so that they grind their flanges on the rail, or when a draft rigging is constantly sending a car to the repair tracks, the men in charge have their attention constantly directed to the causes of delay and expense. But the average body bolster hunches up its back as soon as a heavy load is put upon it, and transfers the major part of the weight to the trucks by the side bearings. Trucks are not designed to carry the load on the side bearings. When the weight rests there it makes the truck so unyielding that the twist given on a curve remains after the tangent is reached, and the truck drags along sidewise, damaging wheels and increasing the resistance.

In the prevailing tendency towards steel for cars we think that a good beginning would be made by using this material for body bolsters. There is also every reason why the truck bolster should be strengthened in the same way. With the present weak combination, the weight and shocks of service soon forces the center of the body bolster up and that of the truck bolster down, aggravating the tendency to carry the weight on the side bearings. Steel would be made rigid enough to resist distortion.

The Great Northern Strike.

The new railroad employés' association—the American Railway Union—have scored a signal victory in their first strike, that on the Great Northern road. This is the first successful strike by railroad men in twenty years. When men combine to resist a reduction of wages below the average of the country, the public are on their side, and railroad officials themselves are glad to see them maintain their pay. Only the fact that all employés went out and tied up the road from the Mississippi to the Pacific saved the day—and the pay—and goes a long ways toward proving what President Debs has so stoutly maintained, that there was strength and safety only in absolute unity. Had any class order struck on the G. N. for the same thing the A. R. U. did, the strikers would have lost their jobs and others would have taken their places at the reduced pay. It has been the hope and ambition of President Debs to keep out of strikes and settle differences by agreements, but he has shown by action that he is a general in the field as well as on the recruiting board. We miss our guess if Mr. Hill, or any other manager of his kind, will not go quite a way to arbitrate with the A. R. U. before they bluff them into a strike. If the officers and members of this new order only keep cool, avoid swelled heads, ask for only what is right and demand only justice—justice for the other side as well as their own—they will do much to elevate and help their own members, and railroad workmen everywhere, and still hold the respect of the railroad officers of the country. That there is strength in a union of all classes of railroad men has been proven. Let us hope, then, there will be no excesses on either side that will call for another clash to prove it over again.

A writer signing himself "Div. 31" in the *Locomotive Engineers' Monthly Journal* takes us to task for saying that it would make no difference with the work of an injector if the feed pipe were enlarged to six inches in diameter, the writer in question claiming that the momentum, rather than the pressure or weight, of the water is what opens check-valve. If "Div. 31" will take the time and trouble to connect up an injector so that it will deliver water into the boiler of another locomotive, and then from that to the one he wants to get water into, that the instrument will get there with the water just as soon as it gets the first boiler full enough to run out—this is enlarging the feed-pipe with a caution, but it will prove something. The writer's assertion that "* * * the present injector will not permit of such a radical change as the substitution of a 6-inch discharge pipe * * *," is merely his opinion —for a simple trial will show him that it will, or a 6 foot one either.

The diversity of locations for the marker and tail lamp (the two being combined), has naturally led us to speculating as to why one road should locate them on the corner posts and another, perhaps a parallel road, should carry them on the hoods, while still another will place them on the rear platform. This, too, by roads supposedly members of the Association. The location, we presume, has been defined, and if so, why it should not be adhered to is the natural query. Crowded platforms of excursion trains make any other position than the hood a dangerous one for these important signals, and why the experience of the Pennsylvania road in this regard has not taught all roads this lesson, seems strange to us.

There is to be seen in the office of Pratt & Letchworth, Buffalo, a list of about 150 names of the older employés of the establishment, all of them having been employed previous to 1870. Some of the men have been in the works since 1860. This firm is celebrated in the neighborhood of Buffalo for the generous treatment accorded to employés. There are numerous stories to be heard which illustrate the benevolent tendencies of the firm. The members evidently have the welfare of their people at heart all the time, and the sentiment finds many kindly expressions. If all firms and companies were like this one we would hear less about the doings of wicked unions.

Our Chart No. 2, the transparent locomotive picture, will undoubtedly become the best known locomotive picture in the world. The demand for it for the purpose of framing has been unprecedented, more than 30,000 copies having been issued. The names of parts have been translated into Spanish, and it will become the official "Dictionary of the Locomotive" for the Spanish speaking countries south of us. Several roads have bought it in quantities to frame for the offices of train dispatchers, etc., etc. It was the "hit" of the season.

We are almost daily in receipt of letters intimating that the writers have had an offer to go to Brazil or other South American countries, and asking our advice about going there to run engines. From all we can learn it's a poor place to go to, wages are no better there than here, money of the country depreciated and climate undesirable. We do not believe that any reliable firm are contracting with men to go to those countries.

Some one signing "J. S. D.," writes "What have you done with my piece about machinists *vs.* firemen engineers? It was sent a long time ago." If the original manuscript was simply signed "J. S. D." it's safe to bet that it has gone to some paper mill, via our waste basket. Don't send anything here that you are ashamed to sign—we've got just as much pride as you have.

The coal strike threw about as many railroad and other mechanics out of work as if there had been a general tie-up. Coal is the stream that turns the mill of mechanical industry, and when that dries up the wheel is liable to stand still and rust away. If the coal miners and the operators don't go to work pretty soon there will be a coal famine in the country.

Some of our contemporaries are standing up on their hind legs and howling about the Coxeyites. It seems to us that the Coxeyites are very much like the green bottle fly, not so awful bad in themselves, but indicating the presence of a carrion somewhere—where? That's the question the American people must answer.

BOOK NOTICES.

TWENTY-THIRD ANNUAL REPORT OF THE RAILROAD AND WAREHOUSE COMMISSION OF ILLINOIS. Published by the State, at Springfield, Ill. Distributed free.

This is the usual railroad commissioners' report, and is filled with interesting statistics. The work only covers the year ending June 30, 1893, but we notice that the railroads in Illinois carried 9,300,000 more passengers that year than it did the year before.

The commission are strong in their recommendation of block signals as safety devices, and speak in the very highest terms of the work and the record of the Hall system employed on the sixteen miles of the Illinois Central out of Chicago.

The report shows that out of a total railroad mileage of 10,349.53 but 690 or 6.7 per cent. are in the hands of receivers, while the percentage of roads in the hands of receivers in the whole country is 12.7 per cent.

The commission ask for legislation that will allow them to *compel* railroads to put their tracks and bridges in better order, rather than *recommend* that they do so.

ENGINEERING EDUCATION; Being the Proceedings of Section E of the World's Engineering Congress. Edited by De Volson Wood, Ira O. Baker and J. B. Johnson. Published by J. B. Johnson, Secretary, Washington University, St. Louis. Price $2.50.

This book contains a number of papers on engineering education, principally by professors engaged in this kind of work. It contains a great deal of valuable information for those interested in the education of young men for engineering pursuits. Among some of the subjects treated are Requirements in Mathematics for Engineering Education, Comparison between American and European Methods in Engineering Education, Field Practice and Field Equipment; Training of Students in Technical Literary Work, Original Research by Students, and a variety of other subjects of minor consequence.

THE MAGNETO HAND TELEPHONE, Its Construction, Fitting up and Adaptability to Every-day Use. By Norman Hughes. Spon & Chamberlain, New York. Price $1.

This little work explains how to make and use magnetic telephones. It will be found a very useful guide to those who wish to fit up local telephone lines of five miles or less, which can now be done without infringing patents. The principles of magnetic telephones are explained in simple language and directions given for every detail of the work.

EXPORTERS' HAND BOOK OF MEXICO. By Phillip G. Roeder, Cleveland, O. Price $2.00.

This is a small volume containing a page or two of abbreviations used in commercial business in Mexico, some general shipping hints and a long list of the business houses of the country. It is intended as a guide to houses selling goods in Mexico.

Those Charts.

Remember that all whose time expires in June, July or August, who renew, are entitled to charts Nos. 1 and 3. No. 2 was sent to all in the March number.

PERSONAL.

Mr. James Roosevelt was, on May 9th, chosen vice-president of the Delaware & Hudson.

Mr. Day Mills has been promoted from the key to be chief train dispatcher of the St. Louis Southwestern.

Mr. J. F. Scott has resigned as master car builder of the Evansville & Terre Haute, and that office has been abolished.

Mr. E. W. Knapp, general foreman of the Mexican National road at Toluca, has been transfered to Monterey, several hundred miles further north.

Mr. A. C. Barstow, Jr., heretofore second vice-president of the Cleveland, Canton & Southern, has been chosen first vice-president of that road.

Mr. George A. Black has been appointed superintendent of the White Mountain division of the Maine Central, with headquarters at Lancaster, N. H.

Mr. E. Richards, chief train dispatcher of the Arkansas division of the St. Louis Southwestern, has been appointed trainmaster, with office at Pine Bluff, Ark.

Mr. Jeff N. Miller, heretofore general superintendent of the Pecos Valley Railway, has been appointed general manager of that road. Headquarters, Eddy, N. Mex.

Mr. F. A. Stinard, a member of the Master Mechanics' Association, formerly on the Erie, has made an engagement with Magnolia Anti-Friction Metal Co., of New York.

Mr. Samuel J. McEwen has been appointed trainmaster of the Rome, Watertown & Ogdensburg, in charge of the Utica & Black River division, in place of Mr. Huggins, resigned.

Mr. M. E. Sebree has been appointed trainmaster of the Chicago, Rock Island & Pacific from Chicasha to Terrell, Tex., both inclusive, and for the Chicago, Rock Island & Texas Railway.

Mr. A. R. Perry, for many years identified with the malleable iron business of the country, has recently accepted the position of traveling representative of the Dayton Malleable Iron Co., of Dayton, O.

Mr. J. P. Reeves, for two years past private secretary to the president of the Chicago & Eastern Illinois, has been appointed cashier and paymaster of that road, with headquarters at Chicago.

Mr. Edward F. Luce has been appointed general agent of the Detroit Lubricator Co., with headquarters at Chicago, and the Chicago office removed from the Western Union Building to No. 941 the Rookery.

The management of the Evansville & Terre Haute have extended the supervision of Mr. John Torrance over the car department, and his title has been changed from that of master mechanic to superintendent of motive power and rolling stock.

Mr. Wm. Rutherford has been appointed superintendent of motive power of the Savannah, Florida & Western, with headquarters at Savannah, Ga. He was formerly master mechanic of the Jacksonville, Tampa & Key West, and before that was on the Florida Southern.

Mr. W. B. Coffin, heretofore superintendent, has been appointed general superintendent of the Jacksonville, Tampa & Key West, with headquarters at Jacksonville, Florida. He was formerly superintendent of the western division of the New York, Lake Erie & Western.

When Engineer William H. Howland drew his month's wages from the Michigan Central pay car, he received a crisp [illegible] full, together with a letter from W. H Vanderbilt complimenting him on the quick run he made from Jackson to Michigan City with the Vanderbilt special recently

Mr. G W Rhodes superintendent of motive power of the C., B. & Q , has been very sick, and it was feared for a time that he was suffering from appendicitis, the complaint which carried away Mr E B Wall. The trouble was, however, found to be less serious, and Mr. Rhodes is able to be about again.

Mr. R T. McKeever superintendent of the Fonda, Johnstown & Gloversville, writes us "Will you kindly insert paragraph to the effect that Mr Lawten Caten severed his connection with this company in April, 1893, and all matters pertaining to purchasing should be addressed to me at Gloversville, N Y."

Mr Thomas R Freeman, the well known railroad supply man, has accepted the general agency for The Hale & Kilburn Mfg. Co., of Philadelphia He has opened an office in the Western Union Building, Chicago. He invites his railroad friends to call and examine the fine specimens of [illegible] he has on exhibition

A St Paul paper recently published a portrait of Mr. W T Reid, lately superintendent of motive power of the Great [illegible] and gave a long account of a [illegible] upon him by a large number of [illegible] who belong to the road which he [illegible] left They presented him with a [illegible] valuable presents, testifying to [illegible]

[illegible] Hon Chauncey M. Depew, president of the New York Central, has consented to deliver an address of welcome at the opening of the Master Mechanics' Convention, at Saratoga, on June 18th. The fame of Mr. Depew as an orator is known the world over. The members [illegible] to be there in force, for the opening [illegible] will be worth traveling a long way [illegible]

Mr William H Tanny has been appointed master mechanic of the Florida Southern, with headquarters at Palatka, Fla. Mr. Tanny has been for several years master mechanic of the Lake Shore, in charge of the shops at Norwalk, O It is understood that some locomotives built by the Brook Locomotive Works lately for the Florida Southern were designed after Mr Tanny's ideas.

Mr L. T. Myers has resigned as general superintendent of the Seaboard Air Line to accept a position with the Richmond, Fredericksburg & Potomac, with which he was formerly connected for eight years. He has been general superintendent of the Seaboard Air Line since May, 1890, and before that date was for five years superintendent of transportation of the Seaboard & Roanoke.

The Fox Solid Pressed Steel Co. announce that their New York office has been moved to the Havemeyer Building, on Cortlandt street That is now where Mr James B. Brady holds forth, and where he is anxious to have his numerous friends call We were there to-day, and can testify that his cigars are as select as ever. There are two things Jim prides himself in having the best of—diamonds and cigars.

Mr. Edward McNeill, general manager of the Iowa Central, has been offered the position of general manager of the Great Northern and declined. The Great Northern is a fine road, but there is too much of a Hill on it to make the life of a general manager endurable A late incumbent of the position said that he liked dealing with bears occasionally, as it stimulated one's fighting tendencies, but to be bossed by a bear all the time was irritating.

The title of Mr. E. W. Grieves, of the Baltimore & Ohio, has been changed from master car builder to that of superintendent of car department. He will report direct to the general manager. This is a genuine compliment to an able man and particularly efficient officer It will please all the members of the Master Car Builders' Association to learn that their president has been thus honored by the management of a great railroad system

Mr W S Morris, superintendent of motive power of the Chesapeake and Ohio, was elected president of the Central Railroad Association of Cincinnati at the last meeting This association is composed of the officers of the operative departments of roads running into Cincinnati, and its principal purpose has been to discuss matters pertaining to car interchange. The election of Mr Morris is quite a compliment, for he is one of the youngest members.

Mr. L B La Rue, the well-known railroad supply man, has been appointed general manager of the Auto Pneumatic Signal Co., of Rochester, N. Y. This company has a plant on the D., L. & W at Buffalo, which has been in use eight months and has accomplished 80,000 movements without a single failure or requiring a cent for repairs. Eight signals and six derailing-points are moved by a single lever, which is so easily worked that a girl could handle it.

Mr. A Dolbeer has been appointed general foreman of the Florida Central, with headquarters at Tallahassee, Fla. The numerous friends of Mr. Dolbeer will be glad to see him in railroad service again. He is known to be one of the ablest mechanical men in the country, and the Florida Central people are fortunate in securing his services He can make more out of nothing in a machine shop than any man we have ever known. There are good opportunities for displaying this creative faculty on most southern railroads these days.

Mr. Theodore Voorhees has resigned as general manager of the Lehigh Valley, and the duties he performed will be attended to by President Wilbur Mr. Voorhees reorganized the whole operating department of the Lehigh Valley, and introduced modern methods which will ultimately be of great benefit to the property, if they are adhered to The mechanical department received the greatest attention, and a reorganization was effected which reduced the machinery to standards. Before this was done, some of the shops were still using odd sized screw threads, and the locomotives on most divisions were built without any regard to uniformity with those of other divisions.

It is understood that Mr G. H. Burrows, superintendent of the western division of the New York Central, who has been on leave of absence for the last six or eight months, will not again resume active duties. This news will be a great relief to many persons connected with the New York Central. Mr. Burrows was a good representative of the class of railroad officers who made tyranny a pleasure, and never failed to say the hardest word and perform the cruelest act when men came up for discipline. With this class of superiors, to be accused of a mistake or a failure of judgment was equivalent to a crime, which must be punished with exemplary vindictiveness. It is safe to say that no officer in railroad service was ever hated so cordially and so generally as Mr G. H. Burrows. His hand was against everyone and everyone's hand was against him, including all the subordinate officers who were subjected to the cutting lash of his tongue, and to the exasperating scourge of his disapprobation. His policy as an officer was to constantly excruciate those whom he considered less zealous and less competent than himself. His policy, which ever generated hatred and scattered seed of revenge, must have been an expensive harvest to the New York Central Railroad It is one of the mysteries of railroad business that such a man should have been so long permitted to cast the shadow of his injustice over the principal limb of a great system. Happily, the era of the tyrant as a railroad officer is on the wane.

As we go to press we learn by a dispatch to the morning papers that Col. R. E. Ricker, late general superintendent of the St. Louis, Iron Mountain & Southern, had died suddenly of heart disease. Col. Ricker had been in railroad service for about fifty years, and was one of the best representatives of the class of managers who liked to supervise every detail. Unlike many members of this class, Col. Ricker was always a gentleman, and his heart was always with the hardships passed through by the men who had to carry out his orders. He was a warm friend of Locomotive Engineering, and a letter from him lately published in our columns, on railroad management, excited wide spread attention. His letter showed, without question, that roads managed by such men as Marvin Hughitt and others of similar stamp, who devoted all their personal attention to the interests of the roads they looked after were prosperous, while competing lines with greater financial influence, managed by amateurs, settled gradually toward the goal of receivership. Col. Ricker had a highly varied career as a railroad man He began as assistant engineer on a railroad in Maine, and gradually worked up to be division superintendent. During the war he was in charge as superintendent of the railroads in Indiana for the War Department Then he was appointed superintendent of motive power of the Pennsylvania Railroad, a position he held for nine years. During this time he devised the system which is now in use, and which keeps the transportation department in close control of the mechanical department. Later on he held the position of general superintendent of the Jersey Central. Then he went to various Western roads, and toward the end drifted upon the Gould roads. He was a man of strong individuality and did not tolerate interference with his duties by high or low He resigned from the Iron Mountain a few months ago, worn out by toil that was indifferently appreciated. He did not long survive being out of harness.

EQUIPMENT NOTES.

The Savannah, Florida & Western placed orders with Pullman for twenty passenger cars

The locomotives for the M., K & T road have not yet been placed. Bids, however, are all in.

Armour & Co., of Chicago, have let a contract to Wells & French Car Co. for 100 provision cars.

The N Y , N. H & H. are reported to have placed orders with the Rhode Island Co. for ten moguls.

Baldwin's people are building three engines for Brazil and two for the United Verde Copper Co , of Arizona

The Hot Springs & Little Rock are in the market for 500 freight cars. They will have M. C. B couplers and air-brakes.

The Florida Central & Peninsular road will in all probability be in the market for additional power for their winter's business.

The Richmond & Danville have placed an order with the Richmond Locomotive Works for two 10-wheelers, and it may be increased to ten.

The Cudahy Packing Co., of Milwaukee, are asking bids for fifty refrigerator cars. These cars are to be built under the Armour Packing Co.'s specifications.

The C , B & Q. people are experimenting with petroleum as fuel for their locomotives They are very short of coal, and wish to be prepared for present and future scarcities.

The Rogers Locomotive Works are working on ten 10-wheel engines for export. They have finished the five engines ordered for the New York, Susquehanna & Western.

The Canda Car Co are busy at their new shops at Cartaret, N. J. They are about completing an order for 300 cars for Cuba, thirty of which are tank cars for carrying molasses.

The Detroit Twist Drill Co. have received a large order for Graham chucks and drills to be sent to Africa. This company report that business keeps up remarkably well. They advertise.

The Westinghouse Air Brake people have received orders within the month for brake equipment for the Northern Railroad of Guatemala. They have also received orders from several railroads in Brazil.

Orders for two hundred and fifty locomotives and several thousand railway carriages have been given by the Russian government to Austrian and Belgian firms, presumably required for the trans-Siberian railway.

In order to avoid setting fire to the pampas by sparks from its locomotives the Buenos Ayres Great Southern Railroad has been experimenting successfully with petroleum as a locomotive fuel, the intention being to substitute petroleum for coal.

A practical man, writing about the Cleveland Twist Drill Co.'s drills, says "The drills you have furnished us are the best I know of. I have drilled two holes in a 66 pound steel rail with two men in exactly four minutes. They very often have drilled 100 holes without being sharpened, and I have one instance of 120 holes by accurate count, without sharpening the drills."

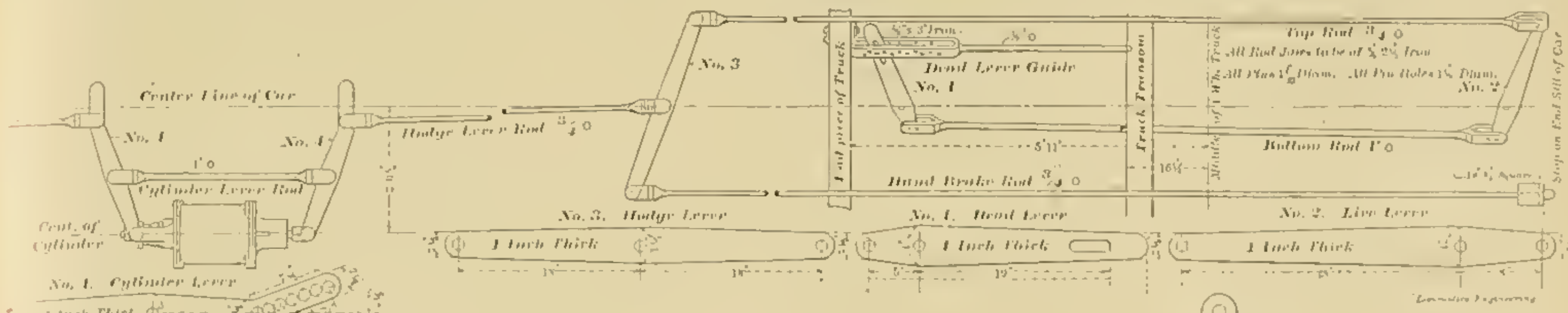
The Santa Fé Railway Company has under construction a large compressed air plant in Argentine, Kan. It is for the cleaning of coaches, but will be used for many other purposes. Pipes are being laid all through the yards, and the air will soon be in use with new patent jacks to hoist cars and engines. Oil will be transferred to all parts of the yards by means of the pipe system, and the sand-boxes on the engines will be filled in a very few seconds by simply turning on an air faucet

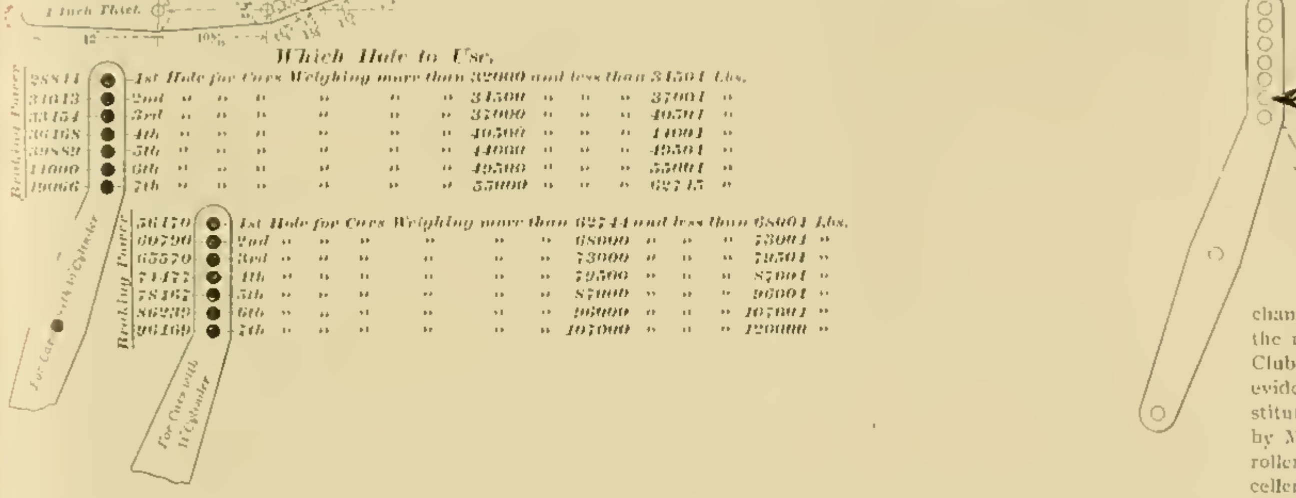
An all-steel box car has been designed by Mr. W. Buchanan, of the New York Central, and full working drawings have been prepared. Mr. Buchanan has had considerable experience with iron cars, and has carefully watched their strong and weak points. The car designed is likely to draw strength from the lessons of long experience. Every detail has been carefully worked out, and the likelihood is that the car when built will be a success. Many iron cars have been made weak by the aim of designers to hang patents on them. There is no patent on this one.

On another page will be seen a striking picture of springs that have been ruined by rubbing against the driving-wheels of the locomotives they were applied to. The thing seems incredible, yet these springs were returned to the maker to have others supplied free of charge, on the ground that they had not worn up to the guarantee. It is amazing to find that any officer in charge of railroad rolling stock would advertise his own incompetency by an action of this kind. If the manager had happened to see those springs, and reflected on the amount of power wasted in grinding them to pieces, questions might have been raised which would place the motive power department in an awkward position.

Haskell's Brake Leverage Plan.

The annexed illustration shows the method followed by Mr. B. Haskell, superintendent of motive power of the Chicago & West Michigan, for keeping the brake leverages the proper length to suit the weight of car. The wheel sliding that destroys wheels on so many roads is due to a great measure to mistakes in leverage. The selecting of levers is often left to men who are not able to calculate the correct dimensions, and frequently they have not sufficient data to figure on. Mr. Haskell's plan leaves no loophole for making mistakes. One set of levers is used for the whole passenger car equipment, and a cylinder lever is painted on the bottom of each car, with an arrow pointing to the hole to be used. This hole, of course, is suited for the weight of car. It would effect a great saving of wheels if all railroad companies would adopt this plain way of finding the right leverage.





That Old Chestnut Wheel Question.

That old, old chestnut, about the top of a wheel traveling faster than the bottom, got a hearing in the paper somehow or other, and now we are buried under an avalanche of explanations, good, bad and indifferent, of how it can and cannot be true. We are not going to open up this old chestnut anne again, and don't publish them for that reason. It has been and can be proven that the top does move faster than the bottom; there is no longer any dispute about it among scientific men, and wouldn't help matters a bit if it were or were not proven true over again.

Photographs have been taken of fast-moving locomotive wheels which show the lower ends of the lower spokes very distinctly, while those at the top are lost in a whirl. This only goes to show that those scientists who have contended that the bottom was momentarily at rest when it touched the rail were correct.

It's one of those things that's so, even if we can't understand it—like love at first sight.

The Associations to Manage their own Business.

Mr. E. W. Grieves, superintendent of the car department of the Baltimore & Ohio and president of the Master Car Builders' Association, writes us that he has sent the following letter to the *Railroad Gazette*. We believe that the views expressed by President Grieves are indorsed by 95 per cent. of the members of both associations.

CONSOLIDATING M. C. B. & M. M. ASSOCIATIONS.

I have read a copy of your letter on this subject, addressed to a number of railroad officers. You did not think best to to ask the opinion of the car builders on this question, but I take the liberty of writing you, nevertheless.

The organization of the Master Car Builders' Association was effected by those who were strictly car builders. After it had become firmly established, and it had become such an important factor in the interchange of traffic throughout the country, some of the large trunk lines that had stood aloof, found it to their interest to become identified with the Association and be represented among its members, any other position being to their own detriment. The Master Car Builders' Association now, with its rules of interchange and the adoption of standards, has become invaluable in the interstate commerce of of the country, and anything tending to interfere with the distinctive work of the Association could not but result in injury to traffic. One could scarcely imagine the utter confusion that would result were the rules of interchange to be suddenly abolished. But while this has not been suggested, no advantage could accrue to either association by a consolidation. The interests of the Master Car Builders' Association take in the whole United States and Canada, while the work of the Master Mechanics' Association is necessarily of limited scope. Engines are usually built to meet the requirements of service in a certain territory, and therefore the construction and maintenance of locomotives does not become a general question, in the sense that the interchange of cars does.

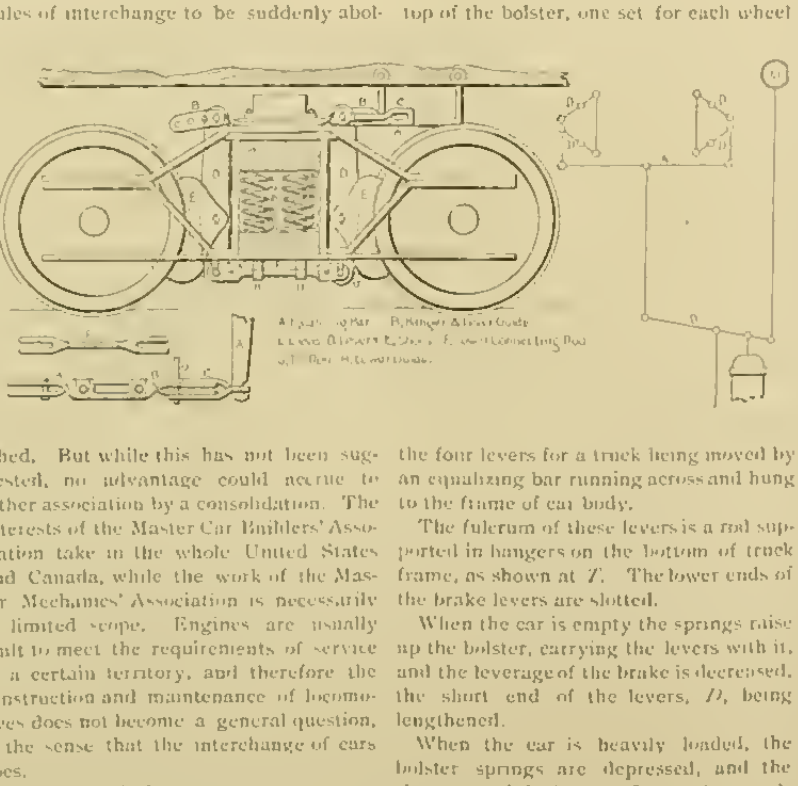
The work of the two conventions, as now conducted, is on an economical basis, utilizing three or four days in the latter part of one week for the Master Car Builders' Convention, and the first portion of the following week for the Master Mechanics' Convention, so that very little more than a week is taken up, if certain officers have to attend both conventions. There could hardly be any saving in time if the discussions on both cars and engines were to be fully carried out.

I cannot see the wisdom there would be in any change, and do not believe the sentiment is in favor of it.

A Beamless Brake with Automatic Adjustment.

The beamless brake here shown is the simplest form of device yet offered to do away with the heavy and somewhat dangerous beam on freight car brakes. The parts are light, as all strains are direct, and the device in itself is an automatic adjuster, braking according to load, and that without the least complication or an extra part.

As can be seen by the engraving, the brake-shoes are hung direct on the levers, or hangers. These are hung from above on a heavy support, bolted directly to the top of the bolster, one set for each wheel; the four levers for a truck being moved by an equalizing bar running across and hung to the frame of car body.



The fulcrum of these levers is a rod supported in hangers on the bottom of truck frame, as shown at *Z*. The lower ends of the brake levers are slotted.

When the car is empty the springs raise up the bolster, carrying the levers with it, and the leverage of the brake is decreased, the short end of the levers, *D*, being lengthened.

When the car is heavily loaded, the bolster springs are depressed, and the short arm of the levers, *D*, are shortened, and the braking power proportionately increased.

The slack is taken up by the usual dead-lever arrangement; one of the hanger-levers acting as dead-lever, as shown.

This brake has been patented by Mr. A. Hendee, of the City of Mexico, who represents the Westinghouse Air-Brake Co. in that section of North America.

Roller Bearings.

The subject of roller bearings for cars is one which the average railroad man would rather not discuss. He has seen and heard of so many failures with roller bearings that he naturally thinks the attempts to change the methods of imposing the load on a journal so that rubbing friction is changed for rolling friction to be based on fallacies, and that the promoters and advocates of such a change are cranks and visionaries. Yet the members of the New York Railroad Club at the May meeting listened with evident pleasure to a paper on the "Substitution of Rolling for Sliding Friction," by Mr. C. D. Maneely, the inventor of a roller-bearing for cars which is giving excellent service on cars belonging to the Delaware & Hudson Canal Co.

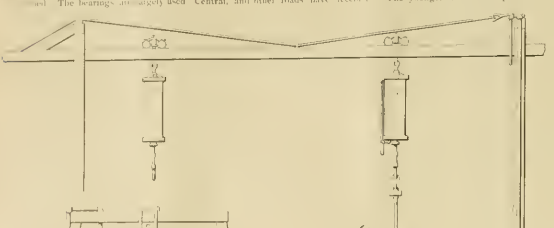
The paper gave a good resumé of the attempts made to introduce roller bearings into service, and drawings were shown illustrating the forms of bearings tried. Roller bearings can be divided into two general classes: Those in which the axes of the rollers are fixed and those in which the axes of the rollers move in the direction of the journal rotation. The first is well known as the grindstone bearing and has been successfully applied to various purposes, but is unsuitable for car journals. The greatest success with cars and all kinds of vehicles has been attained with the second form of roller bearing which includes ball bearings so largely employed in bicycles and light carriages. Mr. Maneely gave detailed particulars of the difficulties encountered with various forms of roller bearings, and outlined the line of improvement which he had followed to produce a bearing that is reliable and durable enough to justify adoption by steam railroad companies.

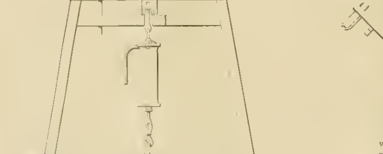
This bearing is composed of steel tubes, uniform in section, which are grouped closely though not in contact with each other, around and in alignment with the journal, and enclosed within a steel-lined cylindrical housing. The tubes are arranged longitudinally in three series, the center series being of double length. Each short tube is in axial alignment with the corresponding tube of the opposite end series, while exactly intermediate to these end lines are arranged the axes of the center series, thus making the lines of bearing equal.

Bearings of this kind have been in use on a Delaware & Hudson Canal car for two and a half years, and has run 138,000 miles without showing any traces of wear. A train of four coaches equipped with these bearings has been running two years, making 117 regular stops daily, and there is every reason to believe that the cars will run ... years more before the bearings need any repairs.

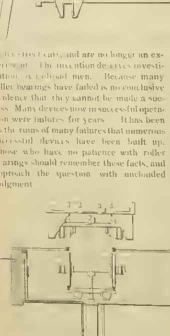
The claims made for the bearing are: A saving of over 90 per cent in power required to start; a saving of 25 per cent. in engine fuel; a saving of 80 per cent in lubricants; absolute prevention of hot journals.

There appears to be good reason for believing that these claims are well founded. The bearings are largely used





on street cars, and are no longer an experiment. The invention deserves investigation by railroad men. Because many roller bearings have failed is no conclusive evidence that they cannot be made a success. Many devices now in successful operation were failures for years. It has been on the ruins of many failures that numerous successful devices have been built up. Those who have no patience with roller bearings should remember these facts, and approach the question with unclouded judgment.



Truck Shop Jack.

The accompanying cut shows an overhead trolley jack used in the Lake Shore shops for handling trucks and loading cars. A 14-inch cylinder with a 4-foot lift is used to do the work. A special rig is used to handle trucks, so arranged that a coach truck can be picked up and turned completely over. Repair men will see at a glance how convenient this would be.

For loading wheels, on or off the axles, trucks, or any such material, the trolley cylinder is most convenient.

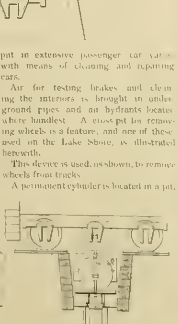
Pit Jacks for Car Repair Shops.

The Lake Shore, Rock Island, Illinois Central, and other roads have recently put in extensive passenger car yards with means of cleaning and repairing cars.

Air for testing brakes and cleaning the interiors is brought in underground pipes and air hydrants located where handiest. A cross pit for removing wheels is a feature, and one of these used on the Lake Shore, is illustrated herewith.

This device is used, as shown, to remove wheels from trucks.

A permanent cylinder is located in a pit,



and the pair of wheels lowered by it upon a small truck as shown.

Another pit jack is shown herewith. It is a telescopic jack and is itself located on a wheel pit truck and air connection made to it by hose. A pair of wheels can be lowered with it, moved to another track and raised up again.

He Turned the Angle-Cock Handle.

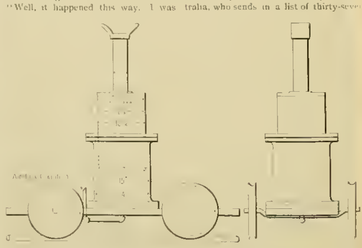
Two young men were sitting in the smoking car talking locomotives. They belonged to the lines west of Pittsburgh, and were members of that class of students which some great railroad corporations appoint as road foremen of engines to instruct engineers and firemen how to perform their duties scientifically.

The younger man whose pinken brow was furrowed with the trials of about nineteen summers remarked: "I got into an awful mess last night," and he leaned back with a far-away look in his eyes, as if contemplating some scene of horror.

"What happened?" asked his companion, with an alarmed look, "you did not run the Limited into the hind end of the Fort Wayne local?"

"No, it was not so bad as that, but it was bad enough.

"Well, it happened this way. I was



riding on the engine of No. 5, and we had to take on a car at Alliance. It was put on behind the baggage car. When we pulled the train up to the station the engineer said to me that he thought there was something wrong with the brakes. Would I go back and see if they were coupled up all right.

"Of course I went back, and I thought that one of the angle-cock handles was wrong, and so I turned it. They have no right to have angle-cock handles that sometimes set one way and sometimes the other.

"We pulled out as soon as I went back to the engine, and I never dreamt that anything was wrong till the engineer tried to stop at the next station. He applied the brakes and they did not hold. Then he whistled for brakes and pulled the engine over but we ran two train lengths past the station. You see I had shut off the air behind the baggage car."

"But do the trainmen on your division not try the brakes when they take on a car at a way station?" asked an inquisitive passenger.

"Perhaps they do sometimes, but I never heard of any rule that required them to do so," answered the scientific road foreman of engines.

"You must be a valuable instructor for trainmen about how to care of air-brakes," remarked another smoker.

"Well, you see that it is by experience that a man learns things," was the reply. "You bet I can tell them to be careful about how they turn angle cocks after this."

"What would have been said if your mistake had led to a disastrous accident?" asked the smoker again.

"That would have been bad, but mistakes are always happening."

And we sadly reflected that the policy of some railroad companies of putting inexperienced youths into important positions prepares the way for serious accidents.

There was a discussion going on in a meeting of railroad managers on the question, "In what way can an automatic system of signals be superior to a manual system?" The manual system advocates were apparently having the best of the argument, when Mr. Robert Pitcairn, of the Pennsylvania Railroad, who is very familiar with all sorts of signals, proceeded to make himself heard. He expressed great admiration for the best of the manual systems, and said they had been exceedingly useful in their day, just as other methods and appliances, now obsolete, had been valuable when nothing better was to be found. But for modern use, he was in favor of a strictly automatic system, which by reliable apparatus indicated without fail when the block was not clear. The leading advantage of an automatic system he declared, was that the controlling spirit never went to sleep, never left its post to have a chat with a friend and never got drunk.

A correspondent in Rockhampton, Australia, who sends in a list of thirty-seven subscribers, says: "Your paper gives great satisfaction here. Its influence has led to the establishing of a debating class in connection with railroad men to discuss matters of mutual interest. The first meeting was devoted to the discussion of your Educational Chart No. 1, and it was a great success. The other charts will be eagerly looked for."

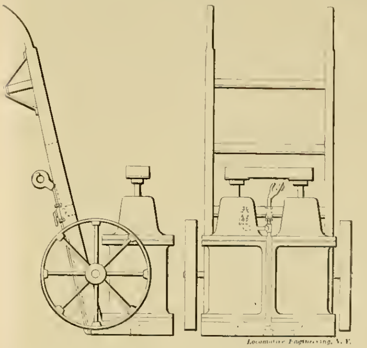
Engineer Cooper, of the Michigan Central, made a fast run on May 3d with the Vanderbilt party. Engine "No. 447," a ten wheeler, left St. Thomas, Can., at 5 20 A.M., and at 7 21 was in Fort Erie, 115½ miles away. This distance in 115 minutes, with a stop for water and slow ups for bridges and switches, is not bad running. This division is particularly favorable to high speed, it's straight and level and the track first-class.

Shop Truck for Lifting Ends of Empty Cars.

The combined truck and air jack shown herewith is a very handy device and made with the fewest possible parts.

The truck is the ordinary hand-truck and the cylinders a pair of ordinary Westinghouse passenger car cylinders, the manner of connecting them, the controlling cock and hose connection is shown.

They are very useful around a repair shop, as they will lift the end of an empty car without trouble, and do it quickly.



Locomotive Engineering, N. Y.

These trucks were designed and built at the car shops of the Lake Shore road, under the direction of Mr. A. M. Waitt, M. C. B.

High Train Speeds.

The popular appreciation of high train speed is altogether comparative. For a few years past there has been an ambition among some railroad men to have a clear record of 100 miles an hour. Although there is no authentic record of that speed having been reached, the nearest possible approach to it is used as the subject of boasting, and stretching the figures in the five score direction is the most innocent and popular subject of lying.

The reckless destruction of truth over train speed has hitherto been confined almost exclusively to this continent and to the British Isles. We are pained to notice that this infection of pride and mendacity is spreading. The Dutch are agitating to have the express trains speeded up away above the velocity of their canal boats, and even sleepy Spain has wakened up, and trains with schedules based on the ox-cart pace are no longer popular. The agitation in favor of higher train speeds in Spain has not been barren of results, for the papers lately have been full of sensational accounts of a train that for two hours kept up a speed of twenty-five miles an hour. We are afraid that some of the newspaper reporters from Buffalo have gone to Spain—the fellows who made out that a certain train was running at the rate of 112 miles an hour.

"A Wimmin's Riteser."

"Speakin' o' wimmin's rights," said the old timer, "reminds me o' Barney Butz and his wife—she was a 'Wimmin's Riteser.'

"Barney had allus lived 'round boardin' houses, where the wimmin folks allus do the work and a man kinder loafs around on the aige o' circumstances.

"At the boardin' house the wimmin allus built the fires, and cu the kindlin', too, and Barney concluded in his heart that after he'd been married a month or so Kate should do like the other wimmin he knew.

"He was awful good at first, but after awhile he uster stay down to the roundhouse when he or't to have got up the coal and kindlin'.

"Kate made a bargain with him, right on the start, he was to git up and build a fire if he'd been in bed a full night, same as she had. If he come in late, why she'd git up.

"But they disagreed on cuttin' the kindlin'. Kate said' twa'n't no woman's work to chop kindlin', and Barney told her every railroad man's wife in town cut her own kindlin'—which wa'n't all true.

"There wa'n't no jawin' or cryin' in it. Jest a sorter good-natured determination to be boss on that pint was evident on both sides.

"Barney went to the roundhouse, leaving Kate without kindlin'. She gin in and cut some for dinner and then informed him that she wuddent never do the like again—'cause, she pretty near cut her foot; cuddent hit straight.

"Barney, he laffed, and 'lowed he'd tamed her at last.

"That night he went out on a hard, long run, and 'long 'bout 12 30 got out his lunch pail to get even with the world.

"Mebby you think he wa'n't took down when he opened that air pail. There was flour—raw, pertaters—raw, beefsteak—raw, egg—jest like it was borned soda, pepper, salt, coffee, shugger, and everything to make a lunch ov—but not a bite to eat.

"Barney was hungry mad, and told me all about it up at the end ov the road—I wuz married ten years, and wuz supposed to know how to handle wimmin.

"I took the young man 'round behind my tank and talked to him for a few minutes, and—well, the next day when I went home I heerd Barney cuttin' kindlin', and he's cut all they used in that house ever since.

"If Barney Butz ever gits offen an engine it will be because his wife Kate's gone to Congress or sumpin'. She knows how to arggee a case with a railroad man, I kin tell ye, say, wouldn't she be a kuter on the ginneral grievance committee'"

Car Box Packing Mixer.

On the Lake Shore they use a device of special construction for mixing, oiling and draining waste used to pack car boxes.

The illustration will make clear this device. As can be seen, the lower part of the box has two compartments of equal size, these are 24 inches square and 25 inches deep, 17½ inches from the bottom there is a strip on each side of the box running across them both, the partition only reaching to the strips; on these strips slides a single box, 24 inches square and 8 inches deep, the bottom of which is a copper screen of ¼-inch mesh. The main box is lined throughout with galvanized iron.

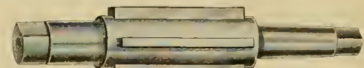
In one end of this box is kept plenty of oil, into which the waste is put to soak. When thoroughly saturated, it is taken out with hooks and placed on the screen, the top box shoved over the oil compartment, and the waste allowed to drip. This waste is used for packing, it is saturated with oil, but not dripping with it, and a great deal of oil now wasted in handling is saved for future use. One end of the box is used for old waste that is fit for further use when properly picked and oiled.

These boxes are located in shops and at points where much packing is done, and it is claimed save lots of trouble—and oil.

On May 5th a freight train on the New England road struck a carriage containing a family, throwing some of them here and there. A young lady and an infant child held in her arms were thrown upon the pilot of the engine. The fireman went out over the running board and held them on until the train was stopped. None of the party were seriously hurt.

Nicholson's Expanding Lathe Mandrel.

Every railroad mechanic fully appreciates the benefit to be derived from any substitute for the old form of solid mandrel. The Nicholson expanding lathe mandrel, as illustrated, possesses many excellent features.



It is claimed to be absolutely accurate and labor-saving the latter claim being apparent, from the fact that it is not necessary, at any time, to make a mandrel suited to the work to be done, or spend any time hunting for one from the "mandrel pile," if the shop is equipped with a standard set, which consists of nine mandrels covering expansion from one to seven inches inclusive.

The mandrel consists of a taper arbor, four taper jaws, and a slotted sleeve to receive the jaws, holding them in their relative position, so that all bind at the same time. The arbor and jaws are made of the best tool steel, hardened and ground, the sleeve is cold drawn steel tubing. The operation to hold work on the mandrel is the same as for solid mandrels, requiring only a blow to set or loosen the jaws. For facing it is especially valuable, as the work is fastened to project over the jaws, which prevents injury to the mandrel, and is done in less time than chucking.

This tool has been on the market for some time, and has received the heartiest endorsements, but it has only recently been offerd to the railroad trade, and is already in use on a number of roads. It is sold by Geo. L. Weiss, 131 Ingleside avenue, Cleveland, O.

The first successful power brake applied to a locomotive west of Chicago was designed by Mr. George W. Cushing, when he was on the Chicago & Northwestern. The brake was applied to the locomotive "Minnie," and was used for many years.

Some antiquarians claim that there is proof that the locomotive engine was known in China two hundred years ago.

The Metropolitan Elevated Road in Chicago have decided to use electricity instead of steam.

Cracking of End Sheets of Fire-Box.

In looking over an accumulation of fire-boxes that had been removed from the locomotive boilers of a prominent railroad lately, we noticed that in nearly every case where radial stay-bolts had been used the fire-box flue sheet and back sheet were cracked, and were more or less furrowed. When we suggested that this premature destruction of the flue sheets was due to strains, set up by the uneven expansion of the outside and inside sheets when the fire [illegible] first lighted, a smile of incredulity re-[illegible] the attempt to impart information. [illegible] men will not believe anything which they do not see with their eyes and cannot measure with a 2-foot rule. They class all [illegible] who believe in the existence of forces [illegible] cannot be stirred with a spoon as [illegible] with amusing views that should [illegible] to with quiet pity and ignored. [illegible] nothing more certain than the [illegible] that when a fire is first started in a [illegible] flue sheet and back expands [illegible] action of the heat and moves [illegible] these sheets are resisted by [illegible] that no movement can take [illegible] strains are put upon the [illegible] This fact has been recog-[illegible] by those who have given [illegible] locomotive boilers the most in-[illegible] and the practice of putting [illegible] which will compensate for [illegible] is becoming general. It is [illegible] railroad men in charge of [illegible] what has been done to [illegible] source of weakness.

[illegible] that there is uneven move-[illegible] the outside shell and the [illegible] box is not new. An Eng-[illegible] hand-book recently pub-[illegible] the following letter from [illegible] well-known ship builder:

[illegible] care cannot be exercised [illegible] with a view to secure [illegible] box the necessary free-[illegible] due to the variations [illegible] In the year 1878 we built [illegible] boat for a foreign government, [illegible] less than eight unsuccessful [illegible] east coming home with the [illegible] To ascertain exactly what [illegible] in the region of the tube-[illegible] moved the row of stays nearest [illegible] plate flange, on the sides and [illegible] box. We replaced these stays [illegible] working in stuffing-boxes and [illegible] nut on the outside, so that if a [illegible] had to be met they were [illegible] receive it, while if the inside box [illegible] to expand it had freedom to do so. [illegible] periment was most interesting. [illegible] time the fire was urged these stays [illegible] move outward through their [illegible] boxes, owing to the expansion of [illegible] In some cases the movement [illegible] sufficient to enable a penny piece to [illegible] between the nut on the stay [illegible] the gland. Each time the fire-door was opened and the temperature reduced, these stays would move inward, and when the boiler was cool the nuts pressed [illegible] on the glands. From the moment the new stays were fitted the boiler was altogether free from leaky tubes, and the boat was duly taken over by the government.

"It is, of course, dangerous to draw a conclusion from one isolated experiment; at the same time it seems more than probable that these stays, as originally fitted, had much to do with the leaking of the tubes, because it is evident that a tensile strain coming on a tube-plate, weakened by being perforated with a number of holes, is likely to distort the plate. As a matter of fact, prior to the new stays being fitted, this tube-plate was more or less altered in shape after each trial. We may assume that the tube-plates should be free from external strains, and, as far as possible, be allowed freedom to move as the changes of temperature require. With a view to carry this out, we make a practice of having the first row of stays at least 7 inches from the edge of the tube-plate flange, and even these stays in large boilers are so designed as to be free to move."

A Tool for Forming Collars and Squaring Up Rocker Arms Under Steam Hammer.

The accompanying sketches show a very handy blacksmith shop tool designed and used by foreman blacksmith F. Bildhauser, of the N. Y. Central shops at West Albany, N. Y.

The plan of the tool is shown plainly in Fig. 1. The tool fits into the anvil block under a steam hammer having a long

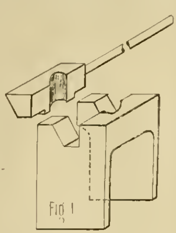


Fig. 1

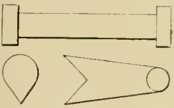


Fig. 2.

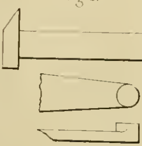


Fig. 3.

Fig. 4.

Fig. 5.

stroke, and the way it comes apart to admit work is shown.

When used for forming collars one end of the round piece is heated, and being blocked up the proper height the top is upset against the clamp of the tool, collars can be formed on pieces having other collars or lugs forged on them.

At West Albany they use this tool for making rockers, and they do this in several ways. In one case, as shown on Fig. 2, they take a piece of round iron the proper size for the shaft and form collars on each end, as has already been described; they scarf one side of the collar as shown, and weld on the arm, which has a V scarf in it.

Again, they form the shaft as above, and scarf the collars and arms sidewise, as shown in Fig. 3.

Another, and a better plan, is shown in Figs. 4 and 5, where a shaft and both arms are formed without welds. In this case the shaft is forged down from larger material and one arm formed in the shape shown in Fig. 4, the tool being used to bend the arms only. After the first arm is properly bent the second is forged as shown in Fig. 5, and then bent and squared up in the tool described.

A Question of Calipers.

We are frequently asked questions by shopmen and others relating to calipers and small tools. A recent inquiry of this kind is from an apprentice, who says that one man will tell him to buy calipers as light as possible, while another will say that the weight has nothing to do with the tool. The answer which we have given this communication will apply to other inquirers.

Much depends on the size of calipers you wish to make or buy. Calipers for small work should be spring calipers with screw adjustment. For larger sizes the screw may be handy, but we prefer the plain calipers with firm legs that will not spring. We have one word of advice to you, and that is that you analyze well the work you have to do, and when you have done so you will readily see what tool will best answer your purpose. The tool is but incidental to the work. Understand that, and you will have no difficulty in selecting proper tools. This mental training is the first training an apprentice should have. Your shop training should help you in this, but do not allow your shopmates to select tools for you.

Knew He Was Color Blind.

He had marks of ancient paint about his garments. There was an anxious, uncertain look on his face as he inquired of the motive power clerk if Mr. Thompson was in.

"No," replied the clerk, "but there he is, coming along the hall."

The marked man walked along to meet the superintendent of motive power, and cheerfully exclaimed, "Good morning," Mr. Thompson!"

"Good morning," was the reply, "but you have the advantage of me."

"Why, Mr. Thompson, don't you remember me. I'm Tom Grimshaw. I worked for you ten years ago."

"What do you want now?"

"I want a job painting."

"I don't believe you are capable of mixing paint properly. You would be sure to spoil lots of material."

"Why, Mr Thompson," answered the son of the brush, "you know I was a good hand when I worked for you before, and never spoiled any material."

"I can't help that, but all the same I know that you are color-blind. Last time I saw you, you told me that I was an old white-headed son-of-a-gun, and I had not a white hair in my head at that time."

Cure for "Freshness."

We spent a half day in a roundhouse lately and observed a few things. For instance:

One fireman was explaining to another how the injector worked—and a very good explanation it was.

The engineer was packing, and, seeing a stranger with a boiled shirt on interested in the explanation, put in his oar; he first reminded the firemen that *he* was "runnin' when they was born," and then commenced to explain the injector for our especial benefit the old vacuum-in-the-feed-pipe explanation.

The whole proceeding was comical in the extreme, and reminded us of the section foreman's rebuke:

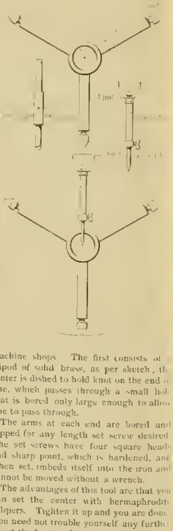
"Putt doon that the can, Jerry Cassaday, and kape away from that push-kayr. Go git youre schovel, there do be oulder min on the job than youse—phwat the divvel do ye know about matchinnery, anyway?"

Device for Centering Line Through Cylinders.

A very important piece of work is to set a line parallel with the bore of a cylinder, and especially in locomotive work. When it is necessary to do so it is always well to be prepared to do it promptly and well.

The old method of doing this was by bolting a piece of wood on the studs in cylinder, or with a wooden brace driven into the cylinder and a large hole drilled therein to admit changing line. The line was usually set with a small piece of wood with a pin in one end, the pin was adjusted to suit the bore of the cylinder. Both of the above methods have been relegated to the past, and there is now in use on the E. T., V. & G. Ry. system, at the Selma shops, a couple of handy and convenient tools that are hard to beat for the purpose of setting lines and holding them in position, without danger of moving.

These tools are the product of the brain of Mr. George Pierce, foreman of the



machine shops. The first consists of tripod of solid brass, as per sketch, the center is dished to hold knot on the end of line, which passes through a small hole that is bored only large enough to allow line to pass through.

The arms at each end are bored and tapped for any length set screw desired. The set screws have four square heads and sharp point, which is hardened, and when set, imbeds itself into the iron and cannot be moved without a wrench.

The advantages of this tool are that you can set the center with hermaphrodite calipers. Tighten it up and you are done. You need not trouble yourself any further about the front end.

The next, in connection with the above and a tool that goes with it, consists of a handy little bipedal extension gauge, and can be made to use in cylinder of any size. It is made of $\frac{3}{8}$-inch brass pipe, with a forked end, as per sketch. Pipe tapped at this end and fork screwed into it and held in place and adjusted by thumb screw, as per sketch. A boss on the other end for thumb screw to hold a $\frac{5}{16}$-inch steel rod that can be extended and reduced as desired. It can be used longitudinally or transversely.

They are both handy tools and once used they are generally continued and adopted.

A circular has been issued by the Leach Sanding Apparatus interests intimating that the litigation concerning rights in the patents is ended. Henry L. Leach now controls the whole business.

The Elements of Boiler-Making—IV.

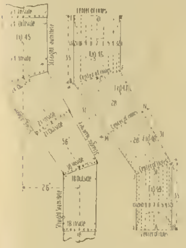
SHEET-IRON WORK.

By C. E. Fourness.*

Laying Out a Smokestack.

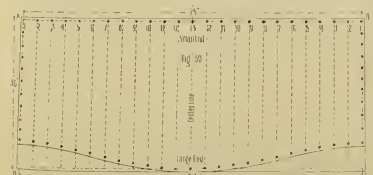
(Continued.)

I now have a taper connection to make between two smokestacks that stand parallel to each other, and 2 feet 6 inches, or 30 inches, apart center to center; one, the upper stack, is 24 inches, the lower 18 inches in diameter The upper one being made larger on account of making connections with another boiler higher up, and thereby requiring a larger cross sectional area to accommodate it: the whole to be made of No. 10 iron or steel, most likely steel, as it is cheaper than iron and works better. (A section or sectional view means to show some part of the inside that cannot be seen without removing some of

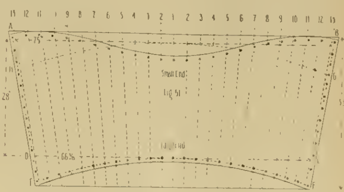


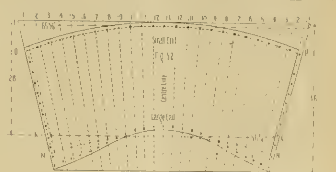
the outside part, as, for instance, if a working drawing of a boiler is made, the interior details like crown-bars, braces, etc., are shown by cutting the boiler crosswise and lengthwise into as many parts as there are important points to show; for if the boiler-maker is merely shown where he is to locate the seams and the kind of seams wanted, that is all he needs of the outside view or elevation—except for the boiler fixtures—and the matter regarding the seams can be shown in a sectional view or given in a note on the drawing. But remember a sectional view can be shown at any point where there is something important to show, and a longitudinal section means lengthwise, a cross section across the boiler; other points are designated as section at *A B* or *C D*, etc.). Fig. 45 is a side elevation. This shows the location of the seams and the appearances of the connection when finished; the straight seams I have on opposite sides in adjoining courses, as a boiler-maker always tries to avoid having two laps come together, or four thicknesses of iron together. I will now start to lay this out. The first thing I do is to draw an outline view (Figs. 46, 47, 48 and 49) by first drawing the center lines *A B* and *C D*, 30 inches apart and parallel to each other. I next draw *B C*, this is 56 inches long, next draw the lines *E F* and *K L*, 24 inches apart and 12 inches each side of the center line *C D*; next *G H* and *I J*, 18 inches apart and 9 inches each side of the center line *A B*; next measure and mark the points 9 inches each side of *B*, on a line at right angles to *B C*. I perform the same operation at *C*, only that I measure 12 inches instead of 9. I now draw the lines *F G* and *J K* through these marks; next draw the lines *K C F* and *J B G* through where the lines cross each other at these points; then draw the lines *H A I* and *L D E* 35 inches from *K* and *G*, and the line *M N* midway between and at right angles to *B C*. This will be the center line of rivet holes if the connection (Figs. 47 and 48) is made of two courses, or the center line to measure from if made of one. Next draw a semicircle 18 inches in diameter, having *I A H* for the diameter and *A* for the center of the circle. Next divide this semicircle into 13 points and number them 1, 2, 3, 4, etc., to 13, beginning with No. 1 at *H*, and then draw the ordinates through these points and just cutting the lines *H A I* and *J B G*. Next draw a semicircle 24 inches in diameter, having *L D E* for the diameter and *D* as the center, divide this semicircle into 13 points and mark them 1, 2, 3, 4, etc., to 13, beginning with No. 1 at *E*, now draw the ordinates through these points and terminate them at the lines *L D E* and *K C F*. Next draw the ordinates 1, 2, 3, 4, etc., in Figs. 47 and 48 between the lines *K C F* and *J B G*, starting from where the ordinates in Figs. 46 and 49 cut the lines *K C F* and *J B G*. This completes the outline.

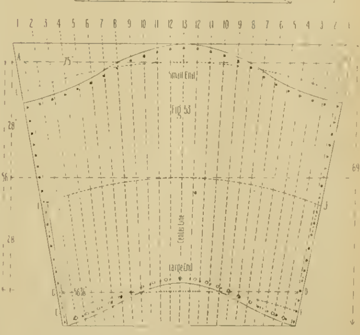
Next in order comes the sheets, and I start with Fig. 50 by first drawing two lines, *A B* and *C D*, along each side of the sheet, 35 inches apart, and an equal distance from each side of the sheet; next lay off the circumference of the large end, 75¾ inches, starting at *C*, one-half inch from the end of the sheet and terminating at *D*. Next erect a center line midway between and at right angles to *C D*, then on the line *A B* lay off the circumference of the small end 75 inches, an equal distance, or 37½ inches each side of the center line. Next divide or space the lines into 24 points for rivet holes, and connect the opposite points with lines and number them 1, 2, 3, 4, etc., beginning with No. 1 at the laps and ending at the center with No. 13 This will bring the straight seam on the right side, as marked in Fig. 45. Next find the camber on the small end, as that end attaches to an ordinary taper course. After this is found set the trams or mark on a stick or strip of iron—that is most convenient—the length of the ordinates between the lines *L D E* and *K C F*, Fig. 46. Starting at No. 1, these lengths are conveyed to the correspondingly numbered lines in Fig. 50; this gives the center of the rivet holes. After these are all located, space off the straight seams for eight holes and draw a line one-half inch outside of these marks for shearing. This allows the lap and completes the course.



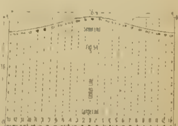
Next in order comes Fig. 51. This is Fig. 47, in the outline view, and you will notice this sheet is 28 inches wide between the hole at *C* and the hole at the intersection of the line *M N* with the line number 7, consequently I draw two lines, *A B* and *C D*, 28 inches apart parallel, and *A B* one inch from the side of the sheet. Next, by referring to Fig 45, I find that this course is 24 inches in diameter outside at the top end; so I lay off this circumference, which I have found previously is 75 inches on the line *A B*. The middle seam of the connection is 21 inches in diameter, and the circumference, 21×3⅐, equals 66 inches plus three times the thickness of the sheet, or ⅜ of an inch, equals 66⅜ inches, the circumference required, As this course must be 21 inches inside diameter, this length I lay off on the line *D C*, an equal distance each side of a center line drawn at right angles and midway between the lap holes *A* and *B*. Next divide the lines into twenty-four points, using two pair of dividers, and being careful not to change them after spacing. Next draw lines through these points and number them from 1 to 13, beginning with No. 1 at the center, and ending with 13 at the straight seams. Next lay the square along the lines 1, 2, 3, 4 etc., to get the camber *G H*. Next find the line *E F*, by using the trams set to 28 inches and measuring from the line *G H*. At the intersection of that line with lines numbered 1, 2, 3, 4, etc., mark across the latter lines for the path of the line *E F*, and draw a curved line (*E F*) along this path or through these points of intersection. Now space off the line *G H*, beginning at the center with the dividers set the same as when the line *A B* was







spaced, and the line *E F*, with the dividers set same as used to space *C D*. I find these points overrun the lines drawn through the points of division on the straight line *A B* and *C D*. Next I center mark these latter points for holes on



the line *E F*, and next draw lines through these and the points just found on the line *H G*. Next transfer the lengths of the ordinates between the lines *M N* and *K C F* (Fig. 47), to the correspondingly numbered lines, the last lines drawn in Fig. 51.

Measuring from the center of the holes

*Foreman Boiler-maker, C. M. & St. P. Ry., Dubuque, Iowa.

[illegible] on the line *E F*, next [illegible] off the straight seams for ten holes and after drawing a line half-inch outside of the center of the rivet holes for the lap the course is ready to shear and punch. Next in order comes Fig. 52. Draw the line *I J* one half-inch from the side of the sheet of which the [illegible] is to be made, then draw another [illegible] *K L* 28 inches from and parallel to [illegible] as that is the distance apart of the [illegible] on the line *M N* and the hole at *B* [illegible] the center line, *B C*, the diameter at [illegible] line *M N* is 21 inches, but this end [illegible] to be 21 inches outside, and the circumference I found was 66 inches for [illegible] 21 inches in diameter, so after subtracting three times the thickness, or [illegible] an inch, I have $65\frac{5}{8}$ inches, the circumference required, which I lay off on [illegible] *I J*, keeping these points or lap [illegible] half-inch from the end of the sheet [illegible] draw a center line midway between [illegible] right angles to *I J* then find the [illegible] rence at the end, *E* the diameter [illegible] 18 inches, 18 [illegible] $56\frac{1}{2}$, and as [illegible] inches in diameter inside add $\frac{3}{8}$ [illegible] which equals $56\frac{7}{8}$ inches, the circumference required. This length lay off [illegible] distance each side of the center [illegible] the line *K L* next space off for [illegible] holes and lay away the dividers [illegible] and draw lines through [illegible] found and number them [illegible] beginning with No. 1 at the [illegible] and ending with No. 13 at [illegible] Next find the camber with a [illegible] end and the trams for the [illegible] gives the lines *O P* and *M N*. [illegible] *O P*. Space this off with the [illegible] same as when the line *I J* was [illegible] points are the center of the [illegible] next space off the line *M N* [illegible] dividers set the same as when the [illegible] was spaced, next draw lines through the points just found on the lines [illegible] and *O P*. Now transfer the lengths [illegible] ordinates between the lines *M N* [illegible] *I J* [illegible] to the correspondingly numbered lines in Fig. 52, and after spacing off the straight seams for ten holes and drawing a line half-inch all around outside of the rivet holes the sheet is ready to shear and punch.

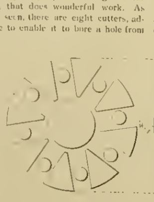
Fig. [illegible] and 52 is the connection made [illegible] two courses. Fig. 53 is where it is [illegible] of one, but it requires an extra wide sheet, as it is 60 inches over all. I will now proceed to lay out this sheet by drawing the line *A B* $4\frac{1}{2}$ inches from one side of the sheet. Next draw the line *C D* 50 inches from, and parallel to, *A B*, as that is the distance apart of the holes *B* and *C*, Figs. 47 and 48. Next lay off the circumference of the top end, 75 inches, on the line *A B*, and draw a center line midway between and at right angles to *A B*. Next lay off the circumference of the bottom end, $56\frac{1}{8}$ inches, on the line *C D*, and an equal distance each side of the center line just drawn. Next space off the circumference between the lap holes *A B* and *C D* for twenty-four holes, and when these are found draw lines through these points and number them 1, 2, 3, 4, etc., beginning with number 1 at the lap, after which find the camber *G H* and *E F*, also of *I J*. This is located midway between *B* and *C*. Next space off the line *G H* with the dividers. Set same as used to space *A B*, and now space off *E F* same length as *C D*. Next draw lines through the new points just found, and on to these last lines transfer the lengths of the ordinates between the lines *M N* and *K C F*, Fig. 47, to the corresponding numbered lines at the wide end of the sheet, Fig. 53, measuring for that end from the line *I J*. These points are the center of the rivet holes at that end. Next transfer the lengths of the ordinates between the lines *M N* and *I B G*, Fig. 48, to the corresponding numbered lines at the narrow end of Fig. 53, measuring from the center line *I J*, and these points just found are the center of the rivet holes at that end. Next space off the straight seams for eighteen holes, and after allowing $\frac{1}{2}$ inch for lap all around the sheet is complete.

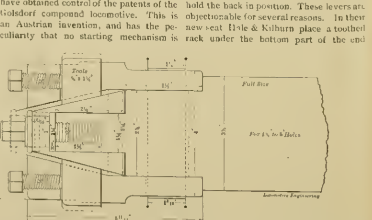
Next Fig. 54. First draw the lines *A B* and *C D* 35 inches apart and parallel to each other, and *C D* half-inch from the side of the sheet. Next lay off the circumference of the large end $56\frac{7}{8}$ inches on the end line *C D*, locating *C* half-inch from the end of the sheet, and draw a center line midway between and at right angles to *C D*; then lay off the circumference of the small end $56\frac{1}{8}$ inches on the line *A B*, locating one-half this amount, $28\frac{1}{16}$ inches, each side of the center line. Next space the sheet at each end between *A B* and *C D* for twenty-four holes. Draw lines across the sheet connecting these points, the centers of the rivet holes, and number them from 1 to 13, beginning with No. 1 at the center and ending with No. 13 at the straight seams, as they will be located on the left side. See Fig. 45. Next find the camber for the holes at the large end, as that end will rivet to an ordinary taper course, and then transfer the lengths of the ordinates between the lines *I A H* and *J B G*, Fig. 49, to the correspondingly numbered lines in Fig. 54, these points just found are the center of the rivet holes. Next space off the straight seams for eight holes, and after allowing half-inch for lap all around the sheet is complete.

But, as I wrote this word *but*, it flashed through my mind "What a word, how often it is used and how much it expresses." How very often, when a job is finished and the person who did the work is asked if it is all right, he will say "Yes, but some little detail is not just right to suit." The *but* in this case is a saving of labor, rivets, and the job will look better. Notice Fig. 54 has the same number of rivet holes in the circular seams as Fig. 50, although the latter is 6 inches larger in diameter. I draw a line through the center of the rivet holes on both ends of Fig. 54 and the narrow end of Fig. 53 where it joins Fig. 54 (I will not touch Fig. 52, as it would require the same treatment as Fig. 53). I set the dividers at about 3 inches and space the ends off for twenty holes, by spacing for this number of holes it locates one at each quarter or on the lines 1, 1, 7, 7 and 13. I show these latter holes by a circle, also on the taper connection sheets I have them marked small end and large end, which seems to be out of place, as the end marked large is the smallest and the end marked small is the largest. I call them large or small same as on an ordinary taper course, the end that fits inside is called the small end the other the large end, or the male end is the small and the female the large end.

A Cutter that Cuts.

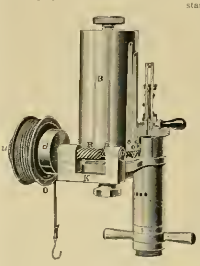
The diagram published herewith shows the form and construction of a boring cutter, used principally for boring out car wheels, that does wonderful work. As will be seen, there are eight cutters, adjustable to enable it to bore a hole from $4\frac{3}{4}$ to 5 inches with one set of knives. This cutter bores car wheels in a first-class manner with a half inch feed—which is some feed. This tool was designed and used by Mr. Wm. A. Foster, superintendent of the Fall Brook Road, who has since patented it, and it is now being made by the Putnam Machine Co., of Fitchburg, Mass.





Houghtaling's Reducing Motion for the Tabor Indicator.

A troublesome thing connected with the application of the steam engine indicator has always been the appliances employed to reduce the motion of the cross-head to suit the movement of the drum. A great variety of appliances have been employed for this purpose, all of them more or less

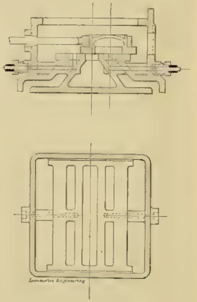


objectionable, and all entailing the use of awkward mechanism. The invention illustrated in the annexed engraving as an attachment to the Tabor indicator seems destined to put an end to the difficulties experienced with reducing motions. The motion is taken direct from the cross-head of the engine to a small pulley moun'ed on a shaft, on which is cut a worm which engages in a toothed spool at the base of the drum. This produces the required revolving motion. The size pulley is selected to suit the stroke of the engine, and the circumference ought to be from $\frac{1}{4}$ to $\frac{1}{2}$ the length of the engine stroke, so that it will revolve four or five times during each stroke. The general arrangement of the invention is so simple that no detailed description is necessary. The details have been worked out with remarkable care and skill. The invention has been put upon the market as an attachment to the Tabor indicator by the Ashcroft Mfg. Co., Liberty street, New York.

Compound Locomotives Without Starting Mechanism.

The Nathan Mfg. Co., of New York, have obtained control of the patents of the Golsdorf compound locomotive. This is an Austrian invention, and has the peculiarity that no starting mechanism is necessary, although in starting high-pressure steam is admitted into the low-pressure cylinder. The method adopted will be readily understood by an examination of the annexed longitudinal section and plan of the low-pressure steam chest. It will be seen that passages are cored through the cylinder castings, which open out in square holes on the valve-seat. These passages are in communication with the dry pipe or the high-pressure steam-chest, and are open all the time. When the engine is working in full gear the valve moves over the openings sufficiently far to admit steam for starting. When the reverse lever is hooked up, it reduces the travel of the valve and thereby keeps the admission holes covered. A rib crossing the inside cavity of the valve prevents the starting passage from admitting steam through the exhaust. The thing is exceedingly simple, and demands no extra attention from the engineer.

The first compound locomotive constructed after the Golsdorf patents was built about two years ago for the Royal Austrian State Railways, and completely fulfilled the expectations entertained, the engine having been noted for promptness and certainty in starting. Those in charge were so well satisfied with the working of the engine that eight more were immediately ordered, and now there are nineteen of them running on the road named. The Nathan people are preparing to push the invention upon the attention of American railroad companies. The simplicity of the engine will certainly appeal to those who favor compound locomotives.



Hale & Kilburn, of Philadelphia, have made a radical improvement in the mechanism for turning their car seats. The usual well-known plan is to employ jointed levers that reverse the seat and hold the back in position. These levers are objectionable for several reasons. In their new seat Hale & Kilburn place a toothed rack under the bottom part of the end frames. A small gear works in each rack, and the two are connected by a rod, which maintains the movement on both sides uniform. This design is very simple, exceedingly strong, and the whole of the reversing mechanism is out of sight. It is the most radical improvement in car seats ever brought out.

—Practical Letters— from Practical Men.

Facts Wanted. There's a glut of Opinions.

Write on one side of the paper, state your point plainly and briefly, and then quit. We supply the generalities. No letters noticed unless name and address are annexed.

A Tool for Tapering Driving-Box Flanges.

Editors:

The flanges of all driving-boxes should be, and, as a rule, are, planed taper on the inside, both top and bottom, in order to allow the box to roll laterally in the pedestal jaws of the locomotive frame when one driving-wheel strikes an elevation or depression in the track.

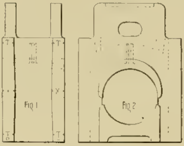
To plane these flanges taper in the old way has been an expensive operation, as it was necessary to chuck the driving-boxes four extra times, and take eight extra cuts down the sides of flanges.

The writer and Mr. F. H. Dersch, our machine shop foreman, designed the new and simple planer attachment shown herewith, whereby we finish the inside of driving-box flanges with one rough and one finishing cut, thereby saving four extra chuckings and eight extra cuts down the flanges of each driving-box.

This cheap and simple arrangement can be put on any planer for doing this or a similar kind of work. This attachment is composed of a cam bar *A*, Figs. 3 and 4, clamped to the planer bed. An upright box frame *B* clamped to cross bar of planer, in which slides the bar *C*, with roller *D* on its bottom end, resting on cam bar *A*. From sliding-bar *C* a right angled rocker, or bell crank, *E*, receives a motion equal to the rise and fall of cam bar *A*. Rocker *E* is pivoted on another frame *F*, also clamped to cross bar of planer. The upper arm of rocker *E* is connected to crosshead or tool head *G* with a connecting bar *H*, on which is a right and left nut *P* for adjusting the planer tool *K*, all connected in such a manner that when the planer tool *K* stands at the proper place on the driving-box flange, the cam *A* produces such a motion to the planer tool *K* that it will plane the driving-box flanges, taper at each end of driving-box, or, in other words, the driving-box flanges will be $\frac{1}{16}$ inch (more or less) thicker at the middle *X X*, Fig. 1, than at the ends *T T*. This permits the driving-box to roll latterly in pedestal jaws of frame, as above mentioned. Any variation in thickness of flanges can be produced, providing the cam bar is properly proportioned.

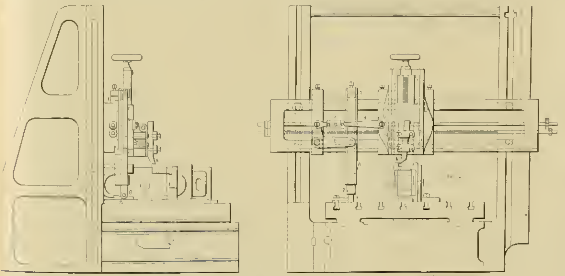
Spring *T*, Fig. 4, is used to provide for any lost motion that may occur; also to keep roller *D* down on cam bar *A*.

This attachment has been in use at the Dubuque shops of the C., M. & St. P. Railway for several months, and is pronounced a success for the purpose set forth. When the attachment is not in use it can be loosened up and shoved to one side, or be removed entirely in a very few minutes. The at-



tachment can be used on either side of planer as desired. Possibly some one may be benefited by the above, as I have benefited by the experience of others.

J. C. Miller,
Dubuque, Ia. General Foreman.



Tool for Tapering Driving-Box Flanges.

Flat Wheels and the Air-Gauge.

Editors:

In looking over a statement of slid flat wheels of a system operating over 3,500 miles, for a period of nine months, in which time 5,470 wheels were removed, at an expense of $22,500, over 50 per cent of which were taken from passenger cars, it struck me that here was a text for a sermon on economy worthy the pen of some of our economists.

It is a significant fact that all roads have been straining every economy during the past year, and that for a purpose. Every employé could, and should, contribute his mite toward assisting them through this, the winter of their distress. A thoughtful use of the oil-can will show quite a saving at the end of the trip, as will also the coal shovel. It may appear insignificant to many, but if practiced by all intrusted with the care and use of material and stores, it would aggregate a sum that would materially assist in reducing expenses.

No doubt but many other roads have their share of the flat wheel affliction, and where is there a broader field for the engineman to display his skill and prove his interest in his employers' welfare? In seeking for a remedy for the evil I am compelled to fall back on an old hobby for relief, and that is simply—brake by the gauge. I know that I am voicing the instruction of the Westinghouse people, don't claim originality. But when that is done and done regularly is when a man commences to brake by a system. In all my observation I have found but few who did their braking in this manner, and their work was noticeable by the regularity and ease with which their trains were stopped. I have been unable in a day's ride to find a man that could make two stops in succession with the same reduction when braking by ear or guess, or whatever you may please to call it. Neither have I been able to find the man who would acknowledge to flattening a pair of wheels when found under his train. It was the other fellow. He don't brake hard enough.

Under ordinary circumstances, a given reduction will produce a like braking force every time, if the auxiliaries are given time to recharge. Any runner should be able to tell in two or three stops just how much of a reduction is necessary to handle his train. Now, let him make his reduction, be it 7, 9 or 10 pounds, as the working of his train demonstrated to be necessary, and he will have time to look at the block, or any other matter that requires his attention. He don't have to devote it all to his brake. It is doing its work all the while, and he don't have to worry after he has started whether he seen the block changed or not. I speak from experience. I've been there. I am aware that this means to many that they would have to educate themselves over again to brake. It means that they will have to educate themselves as to speed, distance and location of road, up to that point that at the required time they can apply their brake with the determined reduction, and bring their train to a stop at the required point. This, I venture to say any man can do in two weeks' careful practice, just as he taught himself to tell by the way his train checks whether it is necessary to make a farther reduction or not. When a man is able to do this, and does it regularly, then he is in a position to assert he did not flatten the wheels under his train, but until he is, he is in the dark, for he don't knew what he is doing.

Then, again, this method will prove a great factor of safety, inasmuch as the gauge will get that attention that it will demonstrate when the pump has stopped, which would not be noticed until a stop was attempted, only to find there was not air enough to do it. Could all the facts be gotten at in some of these disastrous brake failures, it would show that the pump had stopped, and the man in charge had not discovered it. A good reliable pump will naturally lead to carelessness as to the gauge, and that will lead to trouble only a question of time. But what has led us into this habit, and will keep us there until the condition is changed? The position of the air gauge is, above all, most directly responsible. I have yet to find an air gauge placed so that it would be in near line of vision when looking ahead. On the contrary, it is placed where, to get a view of it, one must turn his head at right angles with his point of view, and on our modern engines, if they keep running them up it will require a telescope to get a glimpse at it. This, coupled with a poor cab lamp, renders it well nigh useless after dark. Place the gauge as near the front window as possible, so the eye is continually on it, so it cannot escape attention, brake by it strictly, and the flat-wheel problem will solve itself.

R. S. Gore.
Pittsburgh, Pa.

Past and Present.

Editors:

Nearly all the recent innovations on standard locomotive practice are but revivals of venerable experiments. The oval boiler of the "James Toleman," for instance, was anticipated by the English designer Gray, of the London & Brighton Railway, as far back as 1846. Gray's barrel was a simple oval, and, therefore, differs slightly from Winby's, but it was cross-stayed at its smallest diameter, and was practically a similar solution of the problem to get a large barrel between the wheels. Corrugated fireboxes are not new by half a century either, for they were made in England, to the order of the late Sir Daniel Gooch, in 1844. Gooch, however, adopted corrugated plates, not for their greater strength, but because at equal sizes boxes made of them gave greater heating surface than those made with plain sheets. Even the latest idea of Harveyizing steel tires recalls Gooch's analogous if not identical process of case-hardening wrought-iron tires. The piston-valve is again with us and seems likely to stay, though when such valves were first introduced, in 1833, they found little favor. Compounding is a time-honored institution founded in the early "40's", but the peculiarity about the old compounds was that their cylinders were the same or nearly the same size. The only novelty about pressures of 200 pounds, and thereabouts, to the square inch is that boilers are now built to stand them, whereas the old boilers burst under them sooner or later—generally sooner. Probably every known variety of valve gear has at one time or another been inflicted on the locomotive, and so we find the complicated mechanism grouped round the cylinders of the Belgian engines shown at Chicago last year is but a form of Corliss gear, and that an engine was fitted with the genuine article in this country by Corliss himself in 1851. Perpetual motion has not yet been successfully applied to the locomotive, and there would seem to be a chance of absolute novelty for the inventor in that direction.

Abilene, Tex. Hugh Shake.

Points on Good Firing.

Editors:

As a fireman with over eight years' experience, I will give the method I use in firing soft coal, and if other firemen will give it a fair trial they will agree with me that this method will give the best result.

A great many firemen, when putting in coal, distribute it evenly all over the fire-box, being sure to cover up all the white spots.

This practice, I claim, is not right, as too much of the gas goes out of the stack in the black smoke. The way I put in coal after the engine is working, is to distribute it evenly in a strip about a foot wide, along the side-sheets on each side and in the corners, being careful that there are no holes along side-sheets and in the corners. This leaves a strip across the fire-box, from the fire-door to the flue-sheet, that I do not put any coal on. You will ask how will coal get in the center, if the fireman does not put it there?

I claim that the engine will do it for you. How? When coal is put into the fire-box the heat soon drives the gas and other matter out converting it into coke, and coke being very light the draft will carry it to center of firebox. The corners and along the sides being a little higher after coal has been put in also aids the draft

It can readily be seen what a valuable aid to combustion this strip of incandescent fire is. The fuel furnished to this strip being coke, it takes very little air to burn it, and the draft drawing the gas from the sides to center of box gives more chance for air and gas to come in contact and burn. It will surprise you how soon you will have an incandescent fire all over the box after putting in coal, and how level your fire will be when it is time to put in more coal, and how much lighter fire it is possible to carry with this method.

Another good feature of this method is it is impossible for large clinkers to form in the center of firebox, and every fireman knows to his sorrow what a detriment they are when formed there.

Another feature of importance is, before a fireman opens the door to put in coal he knows just where it is to go, this will greatly aid him in keeping the door open as short a time as possible as he can put the coal along the sides more easily than all over the box. A little effort on the part of the fireman to put a fire in quickly will greatly repay him, as it is much better to keep the steam at a uniform pressure than to let it drop back, to be regained at the expense of the coal pile.

With this method of firing the fireman cannot fire by the stack, as the black smoke soon disappears, but will have to watch the steam-gauge to tell when to put in a fire.

To the many fireman who will read this article and will give it a fair trial, I will refer you to Forney, who says that intelligent firing will reduce the amount of coal used as much as any of the improved draft appliances now in use.

I claim that if engineers and firemen will give this method close attention it will effect a saving of 10 per cent over the other way. H. L. CLARK.

Hobson, Kan.

Metallic Packing Molds.

Editors:

The use of metallic packing is becoming so extensive that it is comparatively an expensive item to keep up the renewals. While it is true this style of packing has proved to be far superior and a great deal less expensive than the old styles of hemp, cotton, etc., the present method of turning the rings on the lathe is both a slow and expensive one, and except where gauges are used, there is a possibility of failing to have duplicate sets of packing. The method described below, of making the packing-rings has been found both economical and accurate. Any size of packing can be duplicated at any time. If one ring in a set should break it can be replaced in a few minutes from stock with the assurance that it will fit.

By a reference to the drawing of the packing-ring mold, it will be seen it is designed for the "United States Metallic Packing." It can, however, be designed to produce any of the different patterns in use. The plate or mold consists properly of three principal parts the base, or mold proper *B*, the top *A*, and mandrels *E*. The space X Fig. 1 and Fig. 2 is the mold for the rings. The mandrels *E* are to form the inside diameter of the ring, and are so fitted to the base plate *B* that they can be easily removed. The diameters of these mandrels should be adjusted to conform to the size of the piston or valve rods for which they are intended. It will be found to give the best satisfaction to increase the diameters by $\frac{1}{64}$-inch. The small dowel or pin shown at *O*, Figs. 2 and 4 is for the purpose of cutting the ring, thereby avoiding the necessity of sawing the rings, and also making it possible to get them off the mandrels with no difficulty.

These mandrels should be well fitted to the base plate, both in the hole which acts as a holder and guide for them, and also on the bottom of the recess cut into the base plate the depth the packing desired. The countersunk holes *F* in the top plate *A* are intended for the double purpose of pouring holes, and after the metal is sufficiently cooled to cut off the gates. The screws *H* hold the top plate against the base plate, producing a ring of uniform thickness. The holes *P* are so arranged as to allow a sliding movement of the top plate. This movement is required to cut off the gates after the rings are poured, and is caused by inserting a small lever in the hole *K* in the base plate and pressing it against the top plate, causing it to cut off the gates and allow the top plate to be lifted off and the rings taken out by knocking the mandrels out with a wooden mallet.

By a reference to Fig. 3 a small section

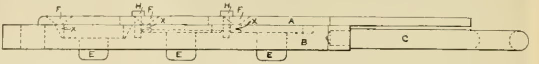


FIG. 1

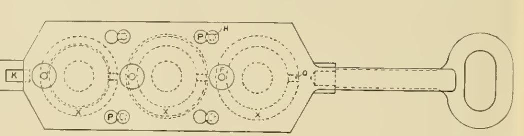


FIG. 2

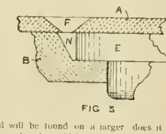


FIG 3

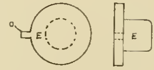


FIG. 4

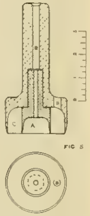


FIG 5

of the mold will be found on a larger scale Before using the mold, it should be thoroughly warmed so as not to chill the metal when pouring, as, if it is not thoroughly warmed the first few rings will be imperfect. If desired, three or four pins can be screwed on the bottom of the base plate to serve as legs to rest it upon.

After the rings are poured it will be found that the flat surface is not perfect. To remedy this, so as to form a perfect joint between the rings in a set, take a sheet of emery cloth and from it cut a disc 6 to 8 inches in diameter, with a hole in the center large enough to go over the mandrel of a small emery wheel, and secure the emery cloth against the emery wheel. If no small emery wheel can be utilized, fit up a center on a small lathe, and fasten a disc of metal on it to act as support for the emery cloth. By placing the rings against this wheel a perfectly true surface is produced in a very short time. The emery cloth can be easily renewed as required.

At Fig. 5 is shown a washer cutter. On many roads gum washers are used for packing the throttle stem, and it is a very unsatisfactory job to cut them with the double adjustable cutter usually furnished. By the use of the cutter shown, these washers can be cut and kept in stock. Referring to the cut *B* is the body, *A* is the cutter for the hole in the washer.

This part is made so it can be removed and replaced by a smaller cutter, sometimes necessary when it is desired to true up and use the old stem. This inner cutter is secured by a pin through the body or it can be screwed in. The holes *B* are for the double purpose of allowing the escape of air and also to allow a wire to be used to push the washer and center disc out should they stick to the cutter. The cutter should be kept throughly oiled, and used on a block of wood. If desired, the center piece *A* can be made solid with the rest of the tool. One or two sizes of these cutters will be found to repay their cost many times.

Reading, Pa. F. M. ARTHUR.

A Suggestion to Card Air-Brake Defects.

Editors:

In the discussion going on in regard to the merits and demerits of the 1892 valve or the reducing valve feature of it, I think Mr. Scott has the best of it. If all engineers would handle it as Mr. Alexander does it might do, but a good many will carry it in release to enable them to make "fly" stops—and it will make lots of flat wheels. Some may say there is a defect hole to keep engineers from carrying valve in release. So there is in the old 1880 valve, but most engineers carry them in release. The holes in most of them are stopped up. There is a good deal of nonsense in the usual excuse given for carrying the 1890 valve in release position. There is need of a "campaign of education," and it should reach far enough to take in the conductor and his crew. If they knew more about air-brakes they would not couple you to a lot of empty air cars, and as soon as angle-cock at tender is opened ask you to try the brakes, they should also be compelled to hang up hose. Go where you may, all over the country, and you will find more hose hanging down than you will hang up in dummy.

It seems to me that there should be some system adopted that would hold good for all roads for the inspection and repairs of air-brakes. We have cars here from nearly all roads in the Union, and nearly one-half of them have something the matter with the brakes. Mr. Holmes suggested a good plan several months ago, but his cars run all the way to California and Mexico. I would suggest a plan something like this Have the conductor or one of his crew carry air defect cards something like common shipping tags, and when they find any defect in brakes state what it is and tie tag to crossover pipe near cut-out cock. The reason why I think that the best place, is because that is where they look first if car is cut out. Such a plan would save time and trouble when crews change, and would help inspectors. In the article by Paul Synnestvedt, April number, under the head, "Locating Leaks," it is all right with the old 1880 valve, but not so with the 1890 or 1892 valves, they have gauge connected to equalizing discharge reservoir. In the catechism on air brakes in back of printed proceedings of Master Mechanics Convention, I see they have left out that lap-the-valve test for train-line leaks.

Bartow, Fla. ORANGE POUND.

Right and Wrong Ways of Fitting.

Editors:

"Despise not the day of small things."

With the view that this may fall under the eyes of some, who, like a certain shop, for a number of years had been in the habit of truing up the ends of tumbling shafts, with a file—not that the men were unable to execute a good job—but from methods which had become unalterably fixed, through the serious error of "not taking the papers," and a decided objection to new men (out of the family), tenaciously clinging to the inheritance that had been handed down to posterity. He, who through a recognition of progress or Divine gift, dared advocate a deviation from the established ways, was not long in receiving the fellowship of disfavor and the decision of being "off his base" But, like Rome in all its pomp and splendor while music by the above note was being ground out, it fell—not the shop, but the band-master and drum-major—and unlike the sepulcher of Moses, the places where they lit are known even unto this day

When rod brass castings, after being "sweated together," are to be finished, it is by no means an uncommon occurrence to see the operator clamp or chuck one, spending much time to avoid a burr, and in shimming up to make it "solid." He starts up and strikes off one side, turns over and gets his fit in length of pin. By way of comment we've seen it from $\frac{1}{32}$ to $\frac{3}{16}$ inch out, but where this line is delegated to certain men it is usually uniform and correct. Now for the strap and rod fit After planing one edge he is careful to try his square as he goes round, well satisfied that "all things worketh together for good," which perhaps they do, till those brasses have to be "took up," when, if the round house man's word is of any value—and they are rarely an exception to the rule of truthfulness and integrity of railroad men—his remarks are punctuated with such powerful interjectional adjectives, that could the "artist" be present he might be persuaded there was something dead up the branch. Well, the work was done well enough and, with but a mite of care, done correctly.

It was as little trouble to place a square on platen or face plate and shim till division line tallied, as it was to monkey in getting it "solid," and equally as simple to transfer parallel pricks or use the square from division line when planing the edges. The brasses then could be closed, lined or keyed with pleasure; on the other hand, annoyance—and if time is limited for the engine, much anxiety to the machinist—as to the result of closing in a hurry, which does not infrequently pan out with a hot pin or delayed train.

It is also handy to take them from shaper to lathe and do *all* the machine work at once; fit them to strap, separate the halves, a little file work on pin fit and it's done. But the best results may be had by separating when it leaves the shaper, fit each half to strap, put $\frac{1}{16}$ to $\frac{1}{32}$ inch liner between them, bore out in strap, plus the liner larger than pin (allowing slack) and the reproduction of the boy with a bucksaw getting wood before day to cook his daddy's breakfast is avoided *in filing out that clearance.*

The same particulars hold good with eccentric straps, than which there is perhaps not a more important job about a locomotive to correctly fit up. We will take off a strap in roundhouse, or a set of straps while engine is on blocks, to be closed, a bolt is given with instructions how much to "take off," which "if he is not up to snuff" he does by very naturally clamping the faced side (if only one) to angle plate or platen and off it goes, and it sometimes happens that the fellow who fits up the job is in a worse fix than he was before he began, inasmuch as, though he may line them up properly when they are hard screwed up, there is a side bind he can't get rid of unless he puts in a tapered shim (which if he is half a man he won't do) or jumps on the fellow that planed them off, who now feels like butting a tree for not observing the plane which is now destroyed, and lays all the blame on the deceptive "face" and the "artist" who originally got them up, and he is right. A strap should be faced on one side at least, of the periphery before doing anything else, then clamp to angle plate or platen, and ends which are to be bolted together may be gotten promptly square. They may now be drilled and bolted together—putting in $\frac{1}{8}$-inch liner larger than desired size of block—in addition to whatever is to be left in them, if any. Bore them out in this proportion, and the job that takes time to chip and scrape (bungling at its best) is obviated, there is no danger of hot straps from this source, and the "other fellow" can't get them wrong whenever they need closing.

Waycross, Ga. A. A. Brown.

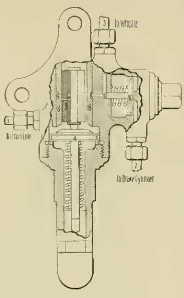
Suggested Safety Device for Air-Brakes.

Editors:

Find inclosed a blue print of low-pressure alarm signal for air-brakes. This device is to be placed in cab of a locomotive, having a whistle attached to it, and when the pressure in the train-line of air-brake falls below a certain pressure from any cause, such as pump stopping, or from brake-valve on engine being on lap, a signal will be given to engineman.

The large piston, No. 4, is kept down to position shown by the air-pressure from train-pipe through the small pipe, No. 1. The slide-valve, No. 5 (similar to one in a triple-valve), is controlled by the stem of piston No. 4. The piston No. 10, and valve 9, operated by piston 10, shuts off the escape of air to signal by air coming from driver brake-cylinders.

We will assume that 50 pounds air-pressure is a safe pressure to stop with. From some cause the pressure falls slowly in train-pipe, but not sufficient to set the brakes. The large spring under piston 4 moves the piston upward, at the same time slide-valve bringing the port 7 through slide valve to connect with the hole in bushing, and the groove No. 6 around bushing and around to valve 9, thence out to air signal,



giving notice that air-pressure is below 50 pounds and brakes not set. The engineer now reduces the air-pressure in the usual way, the same movements of piston and slide-valve are made as before, but with this difference: on account of the reduction being sufficient to set the brakes, the air-pressure from driver-brake cylinders comes up through the small pipe No. 2, moving the piston No. 10, shutting the valve No. 9, preventing the escape of air to signal from train-pipe. Only when the pressure goes below the point the valve is set at, and brakes do *not* set, does the signal act.

When the engine couples on to the train the whistle will blow until the point is reached to stop at, say fifty pounds, which is evidence that the device is all right before leaving. Should the pump be unable to keep up to the pressure required (50 pounds) by becoming out of order during the trip, the engineman simply reduces the tension of the large spring under piston 4 until the signal ceases to act.

The danger lies in the pressure getting low before the engineer is aware of it and wishes to stop. This happens every once in a while, but as nothing happens little is heard of it. We have had accidents in the last year where there seemed to be a doubt about the air brake having insufficient air pressure, or was shut off. Would it not be well to have something of this kind, that would give warning when such a condition as just stated occurs?

The air-brake with the pressure required, and not shut off, will not fail. But with the pressure very much below what is required is not safe in making a stop when the space is limited.

I would like to hear the opinion of railway men on the advisability of using something of this kind to assist the engineman on fast trains at night, and with such facilities as are commonly used in cabs for seeing the gauges at that time. Would it not prevent trouble from such causes as mentioned, and does not the air-pressure shown on the gauges sometimes get below the safety mark before it is discovered?

Warrenton, O. E. J. Lewis.

Test for Leaky Steam, Stand or Dry Pipes.

Editors:

Having read an article in your valuable paper, of the January issue, under the heading, "Wanted—Facts," recalls to my mind a trouble that occurred to me one time on a certain railroad running out of St Louis. An engineer came in and reported his throttle leaking badly. I was the only roundhouse machinist they had, and had pretty much my own way about things, as the general foreman had too much to do to bother me. Well, I ground in the throttle valve, and next morning the throttle leaked so badly that the hostler could hardly keep her on the turn table. The general foreman came around and said to me he thought I had done a bad job. I had no excuse to offer, except that I thought the dry pipe was leaking. He replied that the engineer said that was impossible, as the steam that came out of the cylinder cocks was so dry that it was impossible for it to come from a lower point than the throttle-valve.

The next time she came in, the general foreman said that he would grind in that throttle-valve himself, so I took off the dome cap and he ground it about five minutes and said it was all right. When she was fired up, the engineer said it leaked worse than ever, and several engineers that stood around joked the G. F. about doing a bad job, till he went away in disgust. The next time the engine came in I had a brass nipple made to fit one end in the relief-valve in steam chest, the other end to fit the hose that was used for washing out boilers. I then coupled the hose onto the steam chest and set the right side of engine on the quarter stroke with reverse lever at center notch, thus covering ports on right side. I then disconnected valve rod at rocker arm and placed valve so as to cover the ports on left side. I took the dome-cap off and held my lamp down in the dome and had my helper turn on the water, and found that the dry pipe leaked where it joined to the stand-pipe.

We tried the same test on four other engines of the same class and found them all in the same condition. We fixed them by putting in a copper gasket and never had any more reports of leaky throttles.

I have also used the same test for steam pipes in the front end, as it can be done on a cold engine in the round-house and a man can get in the front end when they are cold, where it would be hardly comfortable with steam on, and steam sometimes leaks only slightly and cannot be seen, and water can be seen easily. There are a great many minor accidents on railroads that are said to be caused by leaky throttles, but if the truth were known it would be found to be a leaky dry-pipe instead. A. E. Cunningham.

Centralia, Ill.

Special Shop Tools.

Editors:

We see advertisements in the mechanical papers and also cuts of new machinery of improved lathes. When we look for the improvement, we find that it usually consists of steel being substituted for iron, or the spindle has been made heavier, or there has been more gears put in the head-stock to save the time of changing from one lead to another; or, may be, there has been put in a friction clutch to change from single to back gear. All these save time, but still it is the old lathe, and the work has all to be done the old way. Is it not true that the lathe, planer and locomotive are virtually the same they were twenty or thirty years ago? The principle is the same. What is bought with a modern locomotive is more looked after and figured on than when a machine tool is purchased? Is it true that the men selling machine tools do not talk up the attachments, or do they not have them?

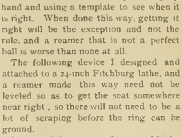
Who would buy a locomotive now without balanced slide-valves, lubricators, sanding device, air-pumps and all the other attachments found on a locomotive when it arrives, and all these are for doing work that can and has been done without them.

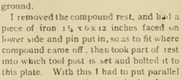
How different when a lathe comes. There will most likely be a counter-shaft, about a dozen gears, a face plate, and two or three wrenches, but not one thing for doing work that is out of the ordinary turning and boring, and if you have anything that is different you must make your own device, and then you find that there is something on the lathe that had better be off, or something left off that if it was on the device that you are going to put on could be much simplified and put on with less expense and maybe work better.

In all locomotive repair shops, and also in other machine repair shops, they use ball reamers, all steam pipe joints are made with ball reamers, and one that is turned in a chuck or on a mandrel by feeding by hand and using a template to see when it is right. When done this way, getting it right will be the exception and not the rule, and a reamer that is not a perfect ball is worse than none at all.

The following device I designed and attached to a 24-inch Fitchburg lathe, and a reamer made this way need not be leveled so as to get the seat somewhere near right, so there will not need to be a lot of scraping before the ring can be ground.

I removed the compound rest, and had a piece of iron $1\frac{1}{4} \times 6 \times 12$ inches faced on lower side and pin put in, so as to fit where compound came off, then took part of rest into which tool post is set and bolted it to this plate. With this I had to put parallel strips between to raise to right height on





under side of plate. On right outside corner I put in tap bolt to fit head of screw *A*, Fig. 1, fastened to slot in carriage with two bolts a piece with hole through center, as *B*, to take *C*, this to be the thickness of slot in nuts on screw *A*. In doing the job, set cross-slide in exact center. Set up screws in cross-rest tight, so that it will not move, then put tool in tool-post, so as it will travel over face of reamer, remove reamer from center, then place a square on exact center of compound and set your tool at the exact radius you want. Put the reamer back between centers, and gauge your cut by moving carriage lengthwise of lathe.

We have made with this device some reamers with 4-inch radius and one with 8-inch radius. If the builders had a similar attachment that could be put on, I should call that an improvement.

Fig. 2 is a chuck for holding anything that has a hole through the center on planer or milling machine, 1 is a side view; 2, a front view. It is all finished; the inside slotted, the outside planed square and the circle turned and slot turned out. 3 is a bolt, with outside of head faced flat and inside bored to same radius of chuck, 4 is the washer, turned to fit inside radius of chuck; 5 is the nut. The slot in chuck is 1 inch, but the bolt should be turned $1\frac{1}{4}$ inches, and then planed flat to go in the slot. It should come $\frac{1}{8}$ inch through, and this can be set at any angle. 6 is for holding the work; the collar is 3 inches diameter, and should have two or three rows of graduations. There should be several of these bolts. The top end is threaded to fit shell reamers and for work that has a hole through and no thread; there can be made a nut with thread and turned off on outside to fit and hold it that way. This will be found very handy. There is a lot of work that [illegible] be done [illegible] cutting teeth in reamers to cutting teeth in bevel gears. There are no sizes given, as different tools would require different sizes, and when one knows what is wanted it does not take long to get sizes.

W. A. ROBERTSON.

Cedar Rapids, Ia.

Running an Engine Underground.

Editor:

Some years ago I was employed by a large railroad and mining corporation on what was called the chain gang. There was a number of us under an M. M. and his assistant, who had charge of all the machinery, including several locomotives. One day our M. M. ordered me to go up to [illegible] and overhaul old No. 2, giving me a slip with instructions. She was a saddle-tank, and I was to saw off everything that was 24 inches above the top of the tank, and when completed she was to be lowered into the bowels of the earth to take the place of a number of "hay burners" in hauling coal. I had for my assistant a young fellow who could play ball some, and who occasionally fired and run her extra. We placed new wheels and driving-boxes under her, also overhauled the running gear. We took off the cab, sawed off the stack and sandbox to clear the top of the tunnel. We were working at the sandbox when our M. M. appeared one day and said: "Hurry, now, and get her in some kind of shape, the Superintendent says we must take her down this evening and have her ready for duty by 6 o'clock to-morrow morning," and I was to stay with the student, as we called my helper, a couple of days until he graduated, for [illegible] to run her. This was more than I [illegible]. I was aware that without [illegible] would be bad medicine [illegible]. I also knew the ventilating [illegible] in the mines would not be com[illegible] for several days yet, also a few [illegible] things not yet in order would make [illegible] as instructor to the student [illegible] unpleasant. We lowered the "2" [illegible] and had her ready, except[illegible] roof, by 6 o'clock next morning. [illegible] me an experience that I hope I may never have to go through again. Our M. M. and assistant was on hand to see that everything went according to schedule. Everything being ready, we buckled up to our empty train and started for our northern terminal. I sat on a wooden [illegible] keg and student on a metal powder-[illegible]. We arrived without anything special [illegible] coupled to our loaded train, and [illegible] until we reached a siding mid[illegible] in the tunnel, where we ran around and got behind the train to push to southern terminal. Just before reaching the southern terminal there was a very steep grade, and at the foot of this grade, for about two rail lengths, there was about four inches of muddy and greasy mine water covering the [illegible], and here also was a door completely closing the tunnel, as part of the ventilation system. A small boy was placed at this door to open it when we arrived, and close it immediately after we got through. In approaching this door the first time I pulled the whistle as a signal for the boy to let us through, and, great Scott! how that sound went through our ears. The boy opened the door and I then discovered that if I did not soon drop her down in the corner I would never reach the top of that grade, so I dropped her down and shut my eyes, and when we reached that water at the foot of the grade the old "2" made about five hundred revolutions per second, and as she had no spark-arrester or grate in her stack she sent chunks of coal as large as hens' eggs up against the roof of the tunnel and spreading them all over us, setting us on fire in about twenty different places. Student jumps off with his metal seat and fills it with nice ice cold, muddy ditch water and gives me a dose to quench the fire on my back, and kept dancing around until I could reciprocate. "Put plenty on," says he, "to dampen me for the next trip." In a couple of hours the tunnel was almost as full of coal gas as it could be, our heads were getting heavy, and we were coughing until our sides hurt. Our M. M. comes to us then and says: "Now you and student go and take a rest, and Pete (his assistant) and I will make a few trips." I complained about it being pretty tough. He replied:

"Oh, you will soon get used to it, and in a couple of days we will have the ventilation perfect and the cab on and that water drained off the track."

Well, they made a couple of trips, and when they would arrive student and I were too sick to laugh; they were having some experience.

"Now, all you have to do," says the M. M., "is to do what Pete and I do. When you feel as though you could not live another minute longer, just stick your finger down your throat, throw up, and you will be as fresh as a daisy."

We did the best we could the balance of that day. I went home that evening and went to bed. I did not get up next morning, nor the next, but student did, however, and about eleven o'clock that day No. 2 was put in her stall and student was carried home.

J. B. WOMER.

Shamokin, Pa.

GETTING [illegible] OF THE GREAT LOGS FOR THE PORTALS OF THE MID-WINTER FAIR, CALIFORNIA.

Explosions of Cuyahoga Engines.

Editors:

There was an explosion of one of the Cuyahoga engines while I was working on the C. C. & C. Railroad or for Wm. F. Smith, that I have never seen the particulars of in print nor have I seen in all my railroad life anything like it, although I have seen a great many exploded boilers. After crossing the Cuyahoga River going toward Columbus, was a forty-four foot grade. On this morning the train was so heavy that they coupled the wood engine ahead of the train engine. The engine attached to the freight was run by a man from the New York Central road, by the name of James Bryant; his fireman's name was Edward Colton, now on the St. Paul road.

It was the back engine that blew up, or her crown-sheet blew out through the fire-box. She went up in the air, they said, about forty feet, turned a complete somersault and landed on the engine's tank ahead of her, with her firebox close to the tank, the smokebox going through the cab of forward engine and killing the engineer instantly. There was nothing left on her when she struck but a piece of her frame on the right hand side of firebox. Everything was stripped off from her. Sol Tuttle, now an engineer on the C. M. & St. P. the fireman of the forward engine, was back in the tank throwing forward wood. This was all that saved his life. I believe he was somewhat hurt. Colton, of back engine, was blown from the footboard some three or four rods, his pants ripped from waistband down. I have seen some four others of those engines blown up, and a number of others besides, but I never saw such a perfect wreck as this was. Bryant died within four or five days after from inhaling steam; had it not been for this, the doctors said they could have saved his life.

I had been to work all night, had washed up and got to the roundhouse doors, when I heard the report of an explosion. She must have been some four or five miles from the roundhouse at the time. Of the other engines of that make which exploded, one was just ahead of the wagon top, the other parted in the center of boiler, and the other near front end or just back of smokestack. The last of those engines built at the Cuyahoga shops were all better stayed than the first ones were, and better iron put in the boilers. It was all iron from beginning to end; boilers, flue sheets and fireboxes were all iron.

ANDREW J. COLE.

Los Angeles, Cal.

Some Lessons of Experience.

Editors:

It was because I did not know much that I came to be plugging a flue that drove through the sheet. Have since been told by old boiler-maker that if I had let water down below flue it would not have driven through. Another time I plugged one with wooden plugs and had no trouble taking train in. I have also tried the plan of plugging a blow-off cock hole with a split plug and wedge on inside, and found it worked well.

Then, again, my engine sprung a leak in the mud-ring, and upon examination I found a crack two inches long in outside sheet. The leak I succeeded in stopping very nicely with a little white lead and cast-iron borings. But I would not advise putting this in where you do not want it to stay, as the boiler-washer says it is just as solid as rock. Another good scheme I have found for a frozen pipe is a bucket of water from the overflow of the injector. Beats fire all out, and does not burn any thing. Furthermore, you can tell just how far pipe is open, as steam will dry water as far as it can get to the pipe.

The way I take up lost motion between engine and tank is with some liners I have, with notches in them that just fit over drawbar, and are just long enough to come up to apron. They do not come out, and a man can rein an engine as tight as he wants to; but wouldn't advise putting in many, unless he knows how much stock there is outside of holes in the end of drawbar.

This scheme has always worked nicely with us, and why more engineers don't use these liners is a mystery to me, as some go along with so much lost motion one would think nothing but check chains were connected.

For the benefit of some other juveniles who may make the same mistake, let me say that the other night I was coming along nicely, and the engine was working as nice as one would want an engine to work. I shut off for a station, and the fireman went to oil valves, but could not, as oil flew out of both sides. When I stopped at station found engine blowing through on right side. Being unable to stop blow by jarring stem and working (as in case of cocked valve), I took up steam-chest cover (there being no air-valve on chest) and found yoke broken off stem. About this time a pusher engine came along, and they had orders to take my train to terminal, which was fourteen miles.

It being a bitter cold night, I did not fancy the job of blocking valve and putting up cover again, so I just hooked in with them, thinking I would not take her down for so short a distance, as I could give her plenty of oil and thereby get in without any trouble. But here was where I made a mistake, as I could get oil into neither side, but as engine had steam I gave her a little to keep cylinders moist, and got in without any damage to cylinders. But the next time I will not figure on giving an engine lots of oil with ports all open on one side.

B. HEAD.

Hannibal, Mo.

Another Kick From Doc.

Editors:

While on the way home from the Air-Brake Men's Convention, at Columbus, Ohio, I met Doc. After expressing his surprise at seeing me so far away from home, finding out where I had been, what for, etc., in true Yankee style, he opened up on me as follows:

"I have got it in for those air-brake fellows. We have got one of them they call an instructor who can't make a good stop at half a dozen stations on the road, I don't believe, for he has never run an engine a foot. He has a car all fitted up with a set of brakes of different kinds, mostly freight, with pumps, brake-valves, signals, etc., all in working order. When he sets the brakes they all work elegant, but what does he know about the condition of the rail, how many long drawheads we have in the train, or how the brakes are going to hold? His set of brakes don't show any greasy rail to stop on or any down grades, it don't shake you up by holding on tight just as you get stopped, you have to take his word for that. Of course, it is all very nice to see how all these things are made, and look at the various parts of which the air-brake system is composed, when it has a section cut out so you can see all the openings, when and how they open and close. You get a better understanding of it. But it makes me tired when he examines you and asks what you would do if something breaks or they don't work just right, and some young fellow that never made a stop with a passenger train in his life jumps up and tells all about it. I am a little slow about explaining these things, I will admit, but the fellow with the ready tongue gets the best of it. Here is the card I got from him after the examination was over. It says I am rated fourth in a general understanding of the principles and operation of the air-brake.

"Lots of things he asked the boys I

can't answer, but as luck would have it he hit me with questions I was at home on except one, that was about finding leaks in the brake-valve. I told him I always reported the valve to be examined when it did not work just to suit me, and let the fellow in the shop, whose business it was, find out and fix it. He said that was a sure way if I got to the shop *in time*. He says to me, 'Does it take any longer for the brake to take hold after you have set it tight once, let it off, and want to set it again in a few seconds?' I says, 'Yes, it does, but I don't know just why, sometimes it works so slow you will run by, and when it catches on everything goes with a jerk.' He showed me all about it. By watching the gauges, I learned that part of it quick. What good are all these meetings and conventions they are having? Every few days you hear of one, and every railroad paper is full of them. I suppose the call-boys' turn will come next. Everybody else attends some kind of a convention. What did you fellows do at the air-brake men's meeting? I suppose our man was there, he has not been on exhibition this week."

In reply, I told "Doc" he must take into consideration that there were lots of kinks in the handling of the air-brake that he had not got on to yet because it had never been his bad luck to run across them, but when he did it would save him trouble in finding out the how and why of getting out of it if he knew how all the parts were expected to operate. It used to be the practice to brake by hand when the least little thing went wrong with the brake on the train. Now it has to be fixed or another engine secured that is all right. Nobody dare trust a passenger crew to hold the train with hand brakes if the time is fast and train heavy, it can't be done; the men don't know how; some of them have trouble in switching their own train at terminals. It is not the fault of the train crew, because it is getting to be none of their business.

The engineer is in the place where he finds out first if the brake don't work, and he is pretty well fixed if he knows *why* it don't. I saw your instructor. He is a quiet good-natured young man, who not only knows his business, but knows how to tell you about it, as you admit. Never mind the fact that some of the young fellows can answer up so quick; they learn easy when they are young. Probably, if you had learned to adjust the brake-shoe slack by the piston travel, instead of by having the shoes just the right distance from the wheel, you would not get called on the carpet—see page 100 LOCOMOTIVE ENGINEERING.

Now, as to why these conventions are held. Railroad men have found out that they will learn more at one meeting of this kind than by working along on their own road for six months. They meet other men in their special branch of business, who tell of their difficulties and how they were overcome; of their failures, and what causes them, if they know. So it is better known how to meet them when they come up. Associated effort in learning how is better than the "go-as-you-please" style. Now that it is recognized as a fact, every one engaged in a special line of work on a railroad wants to meet the others, and take advantage of what they know about it. There are a few members who air their views without being sure they are right, but somebody shows them their mistake right off, that widens out their observation and increases their experience, and none of us are too narrow-minded to profit by it. Papers are read on various subjects, there is a running fire of comments from the members on the ideas advanced, so all around the subject is thoroughly discussed and better understood. Some of them aim high and seem to shoot over the subject, but they have an object in it. You know, Doc, that you hate to give up the old way of doing things, and don't like to tell the young fellows coming up around you about lots of things you ought to. You think they ought to learn it as you have done, by hard knocks and sad experience. If you don't want to show the young men how, don't get in the way of those who are trying to. Every instructor needs the help of the old heads on the road.

Mr. Editor, the air-brake men's meeting was a success. There were some able papers; the various committees got right down to business, there were no hitches in the proceedings, all questions were discussed intelligently, a good programme for the next meeting laid out, and I hope to see some of our old friends like Doc sitting on the back seats as spectators. They will be welcome.

CLINTON B. CONGER.

Grand Rapids, Mich.

On Bishop's Angle-Cock.

Editors:

Would like to make a criticism on E. P. Bishop's new angle-cock as illustrated in the May number of your paper. As it stands, one can cut out train-pipe without notifying any one by simply closing signal stop-cock first, then closing train pipe cock. Would suggest that to make his device effective and proof against accident or malice, he should use the same pattern of angle-cock on signal-pipe that he uses on train-pipe. Then connect its relief or safety-valve with another cross-pipe having its inlet in the train-pipe angle-cock back or outside of the plug. Then, if the signal-cock was turned, it would set the brakes; and if the train-pipe cock was turned, it would notify the engineer by means of the gauge and whistle.

The back end of train needs no extra attachments, as, when both cocks are closed, both pipes are sealed. Both cocks might be combined in a single casting, which would make less joints. With this construction, in cutting out an engine or car, you would lose all air from signal-pipe. Signal stop-cock would only be turned in rear of last car. If it were not for the serious loss of time and air every time a train is uncoupled, the best plan would be to take all angle-cocks off, and couple each hose of rear end into a dummy coupler.

Erie, Pa. PORTER STAFFORD.

Durable Packing.

Editors:

We have an 8-inch Westinghouse air-pump on engine 289, which has been running, making an average of 3,500 miles per month, since January 5, 1891, and has never had the air end of pump packed. It is still in service and has never leaked any and we don't know why it doesn't leak. We would like some of your air-brake experts to explain why this pump has run so long without leaking.

C. E. SHERWOOD.

Livingston, Mon.

That Defective Cut.

Editors:

In the May issue, Mr. Geo. Lynch asks a question about the relative position of the feed ports and handle shown in the March chapter of my article on the engineer's valve, Fig. 6, Plate 11. The cut is the same as that in the latest Westinghouse catalogue, the inaccuracy mentioned not having been noticed before. The ports and rotary-valve are in the proper position, but the handle is merely indicated by a couple of circles, the draughtsman probably not considering it, in this cut, of sufficient importance to require an accurate projection.

Chicago, Ill. PAUL SYNNESTVEDT.

How to Stop Noise in Pump Governor.

Editors:

Reading what others have to say about the noise and remedy of pump governors, just reminds me that the first governors put on engines here were very noisy affairs, and as a consequence very unpopular with the enginemen. We soon found out, though, that the noise was not caused by any defect of the governor, but the position in which it was placed, that is, it was put on the steam-pipe inside of cab and above small lubricator, so that it was perfectly dry. They were afterwards changed to the pipe outside of cab, so that the oil from the lubricator passed through it, which put a stop to the noise entirely.

North Platte, Neb. W. W. WOOD.

Movement of Cross-Head.

Editors:

I have noticed a number of pieces in the paper in regard to the movement of the cross-heads on a locomotive. A cross-head with a 24-inch stroke will, from any stationary point, move in the backward stroke 24 inches less than one-half the circumference of the wheel, and in the forward stroke it will move 24 inches more than one-half the circumference of the wheel when engine is running ahead.

Chicago, Ill. B. H. HAWKINS.

Air-Brake Questions.

Editors:

WHAT MIGHT CAUSE THE SIGNAL WHISTLE TO BLOW.

In the March number of LOCOMOTIVE ENGINEERING, Brother Relyea gives us a whistle puzzle. There are now two styles of signal valves used by the Westinghouse Company, one shown in the 1886 catalogue and the other in 1890 catalogue. He does not state what kind it was, but if it was the kind shown in 1886 catalogue, the trouble would be caused by the diaphragm. I often find the holes in these diaphragms stretched so wide that they do not fit the little flat tube. The flat bearing on the inside next the center of the valve is so narrow that when the hole in diaphragm becomes enlarged, the casing does not hold the gum tight and the air will leak around it so that you can cause the whistle to blow by rapping the signal-valve with your hand.

LOOSE WAY OF MAKING REPAIRS.

I was amused when I read the little article on page 138 of March number, describing the way a fresh individual examined triple valves on cars. It reminded me of another case of a man fitting air valves. The engineer of the engine asked him how he got the lift, when he replied "Oh, I jist make him shake around."

I suppose he filed some off the stem or tit, then he would hold the discharge valve on its seat and shake the receiving valve. The instruction book of the W. A. B. Co.

RED WOOD LOGGING SCENE IN HUMBOLDT COUNTY, CAL.

will tell the proper lift for the air valves in the 6-inch, 8-inch and 9½-inch pumps if the air-brake doctor will only take the trouble to look it up. I will give it

8-inch pump—receiving valve, 5/32 inch; discharge valve, 1/8 inch.
6-inch pump—receiving valve, 1/8 inch; discharge valve, 1/16 inch.
9½-inch pump (all four valves same)—receiving valve, 3/32 inch; discharge valve, 3/32 inch.

There are certainly some quack air-pump doctors roaming around loose that it seems to me should be made to resign for the benefit of the traveling public. I have taken new valves out of air-pumps repeatedly that had no lift, only what would be made by wear in coming from Jersey City to Camden. I recently had to take an engineer's brake-valve off on account of a groove cut in face of rotary-valve, around the pin or post in the center of the valve. A groove about 3/16 inch wide and 1/16 inch deep is recommended by some air-brake men, but in the case referred to the groove was about four times as wide as it should have been—so wide that the engineer could not use it on lap at all. When he wanted to apply the brake he would have to let all the air out of train pipe. If he made an ordinary service-stop application, and placed it on lap, the brake would go off right away. The engineer got from Jersey City to Camden with it but would not leave Camden with it. The valve had to be faced off down level with the bottom of the groove. Result, no more trouble with it.

I sometimes find the upper valve chamber bush put in and made oblong by the chamber bush set screw being screwed up hard against it, so that the air from reservoir or discharge-pipe leaked past the upper discharge valve on two sides, and held the upper receiving-valve down so that it would not draw the air in on the down stroke. The chamber bush should have a hole in its side for the point of screw to go in. The screw should be screwed up tight, so that the head of it jams against the pump, and the point of screw should fit loose in the hole in valve bush, the object of the screw being to keep the bush from turning around in the chamber, so that the port in pump and the hole on side of bush will be in line when the chamber cap is screwed down. The cap should fit tight on top end of bush and tight under its own flange against the pump at the same time. The bush should be ground in so that the two shoulders on it will both be air-tight.

I think that all engineers should read the letter in March number, page 123, on the "Sudden Disappearance of Oil in Sight Feed Lubricators."

FRED. B. ARMSTRONG.
Camden, N. J.

In order to compete for prizes your drawings should reach this office by June 10th at the latest.

An Interesting Experiment with a Locomotive.

The accompanying drawing shows the valve-lifting device recently placed on a locomotive belonging to the Fall Brook Railroad.

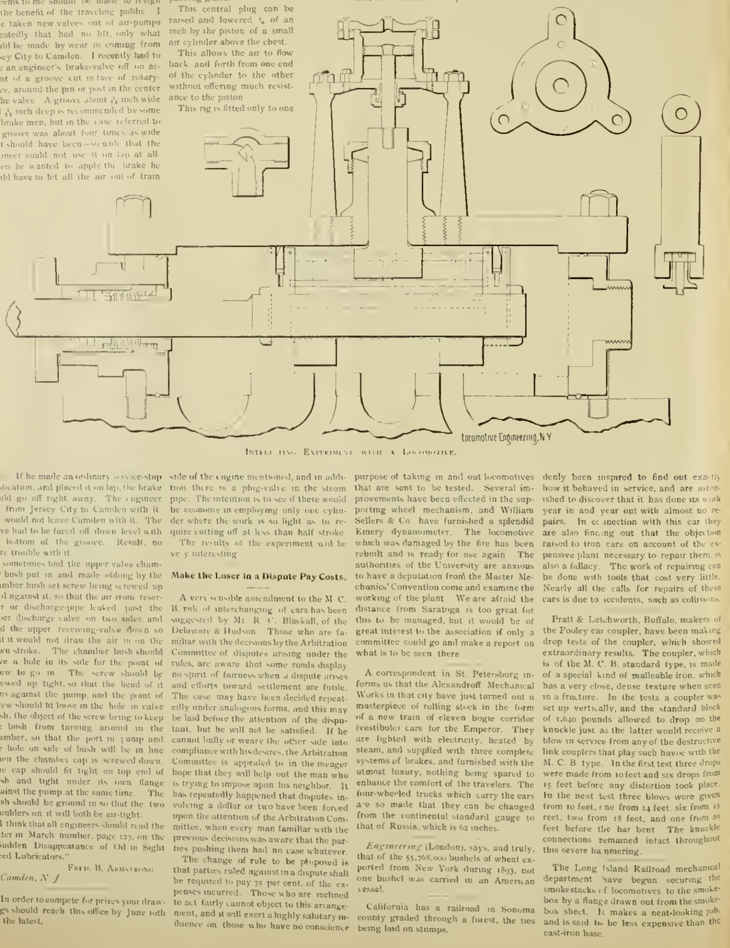
As can be seen, the valve is balanced, but in the top of it are tapped three bolts holding a strip that slides in a T-slot in a heavy central standard that extends up through the chest cover with a suitable packing gland.

This central plug can be raised and lowered ¼ of an inch by the piston of a small air cylinder above the chest.

This allows the air to flow back and forth from one end of the cylinder to the other without offering much resistance to the piston.

This rig is fitted only to one side of the engine mentioned, and in addition there is a plug-valve in the steam pipe. The intention is to see if there would be economy in employing only one cylinder where the work is so light as to require cutting off at less than half stroke.

The results of the experiment will be very interesting.



INTERESTING EXPERIMENT WITH A LOCOMOTIVE.

Make the Loser in a Dispute Pay Costs.

A very sensible amendment to the M. C. B. rule of interchanging of cars has been suggested by Mr. R. C. Blackall, of the Delaware & Hudson. Those who are familiar with the decisions by the Arbitration Committee of disputes arising under the rules, are aware that some roads display no spirit of fairness when a dispute arises and efforts toward settlement are futile. The case may have been decided repeatedly under analogous forms, and this may be laid before the attention of the disputant, but he will not be satisfied. If he cannot bully or weary the other side into compliance with his desires, the Arbitration Committee is appealed to in the meager hope that they will help out the man who is trying to impose upon his neighbor. It has repeatedly happened that disputes involving a dollar or two have been forced upon the attention of the Arbitration Committee, when every man familiar with the previous decisions was aware that the parties pushing them had no case whatever.

The change of rule to be proposed is that parties ruled against in a dispute shall be required to pay 75 per cent. of the expenses incurred. Those who are inclined to act fairly cannot object to this arrangement, and it will exert a highly salutary influence on those who have no conscience in dealing with other railroad companies. The principle advocated is recognized as just in all other lines of litigation, so there is no reason why it should not apply to disputes in the interchange of cars.

We are informed by Professor Goss, of Purdue University, that the locomotive testing laboratory which was destroyed by fire some months ago has been rebuilt, and a greatly improved plant introduced. They have a track connection with the Lake Erie & Western entirely finished, for the purpose of taking in and out locomotives that are sent to be tested. Several improvements have been effected in the supporting wheel mechanism, and William Sellers & Co. have furnished a splendid Emery dynamometer. The locomotive which was damaged by the fire has been rebuilt and is ready for use again. The authorities of the University are anxious to have a deputation from the Master Mechanics' Convention come and examine the working of the plant. We are afraid the distance from Saratoga is too great for this to be managed, but it would be of great interest to the association if only a committee could go and make a report on what is to be seen there.

A correspondent in St. Petersburg informs us that the Alexandroff Mechanical Works in that city have just turned out a masterpiece of rolling stock in the form of a new train of eleven bogie corridor (vestibule) cars for the Emperor. They are lighted with electricity, heated by steam, and supplied with three complete systems of brakes, and furnished with the utmost luxury, nothing being spared to enhance the comfort of the travelers. The four-wheeled trucks which carry the cars are so made that they can be changed from the continental standard gauge to that of Russia, which is 62 inches.

Engineering (London), says, and truly, that of the 55,768,000 bushels of wheat exported from New York during 1893, not one bushel was carried in an American vessel.

California has a railroad in Sonoma county graded through a forest, the ties being laid on stumps.

The New York Iron Car Co. have about 8,000 of their cars in service. The framing of these cars is made of tubing, a feature which attracts attention when any of these cars are seen on a train. How seldom one of that 8,000 cars are seen in trains is a good illustration of the vast number of cars that are in use on our railroads. Since Mr. Joughins read his paper at the New York Railroad Club on iron cars, the New York Iron Car Company's design has been growing in grace. Other roads that have looked askant at the iron car have suddenly been inspired to find out exactly how it behaved in service, and are astonished to discover that it has done its work year in and year out with almost no repairs. In connection with this car they are also finding out that the objection raised to iron cars on account of the expensive plant necessary to repair them, is also a fallacy. The work of repairing can be done with tools that cost very little. Nearly all the calls for repairs of these cars is due to accidents, such as collisions.

Pratt & Letchworth, Buffalo, makers of the Pooley car coupler, have been making drop tests of the coupler, which showed extraordinary results. The coupler, which is of the M. C. B. standard type, is made of a special kind of malleable iron, which has a very close, dense texture when seen in a fracture. In the tests a coupler was set up vertically, and the standard block of 1,640 pounds allowed to drop on the knuckle just as the latter would receive a blow in service from any of the destructive link couplers that play such havoc with the M. C. B. type. In the first test three drops were made from 10 feet and six drops from 15 feet before any distortion took place. In the next test three blows were given from 10 feet, one from 14 feet, six from 15 feet, two from 18 feet, and one from 20 feet before the bar bent. The knuckle connections remained intact throughout this severe hammering.

The Long Island Railroad mechanical department have begun securing the smokestacks of locomotives to the smokebox by a flange drawn out from the smokebox sheet. It makes a neat-looking job, and is said to be less expensive than the cast-iron base.

*Diseases of the Air Brake System; Their Causes, Symptoms and Cure.

By PAUL SYNNESTVEDT.

The Triple-Valve.

(Plates 17, 18, 19, 20 and 21.)

There is probably no complaint more common amongst trainmen and engineers than "*The triple-valve sticks.*" It is safe to say that in nine out of ten cases where this complaint is made the triple-valve is *not* to blame at all. It is merely the index which shows a defect somewhere else in the apparatus, for the triple-valve being the automatic part of the brake, the foundation of the whole system, is the first part to be affected when anything else gets out of order. In quite an extended experience with air-brakes the author does not remember more than a few cases where triple-valves were so defective as to be absolutely inoperative. They must be in very bad shape indeed if they will not work at all.

BRAKE WILL NOT SET.

In case the triple-valve refuses to act, the first thing to examine is the auxiliary reservoir, as that may not have its full supply of air and, of course, as it is the air in the auxiliary reservoir that moves the triple-valve pistoo, a deficiency of pressure there will prevent the valve from acting. Sometimes the bleeding cock will be found left open or leaking, and sometimes there is a leak somewhere else about the reservoir of sufficient extent to prevent the proper accumulation of pressure. All the pipe connections about the reservoir should be very carefully examined.

In case the reservoir contains considerable pressure it is of course useless to look for leaks, and the attention must be turned elsewhere.

DIRT IN STRAINER.

The strainer (plate 17, No. 16) where the train-pipe connection is made should next be examined, as it sometimes becomes completely stopped with dirt. Strainers in this condition are shown on Plate 18b. They were taken from actual service.

They may be in such condition that they will permit sufficient air to filter through to partially fill the reservoir after a considerable length of time, and yet not allow the pressure to escape fast enough from the train-pipe side of the triple-valve to cause the brake to set. If there be plenty of air in the reservoir, and all the passages are found to be free and open, the only remaining inference is that the main piston itself is "stuck," and this should then be taken out and cleaned.

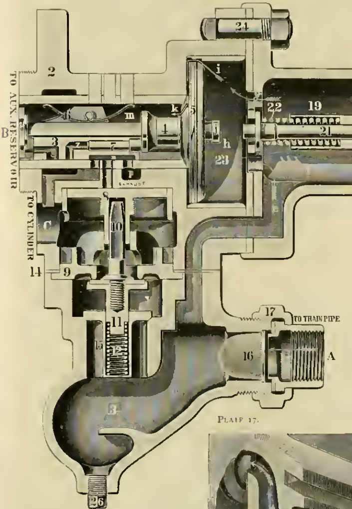


PLATE 17.

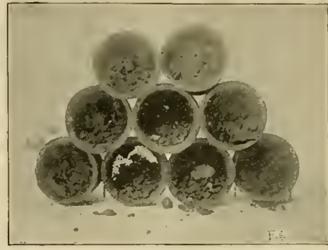


PLATE 18b

FROZEN TRIPLES.

In very cold weather there is always the possibility that the valve may be frozen, especially if it is on a car near the head of the train and the main drum on the engine has much water in it. The author has located more than one negligent engineer, with his main drum half full of water, by discovering an excess of moisture in the triple-valve under the baggage car which he pulled regularly.

BLOW FROM EXHAUST.

If there is a constant blow-out of the exhaust of the triple-valve (or the pressure-retaining valve which is connected to the triple-valve exhaust) the first thing to determine is whether it comes from the *train-pipe* or *auxiliary reservoir*. This can be very easily done by cutting out the valve with the cut-out cock

If the blow does not stop for some time and then grows fainter gradually, there is little question but that it comes from the reservoir, but if it stops immediately and the brake sets, it is a clear indication of a leak from the train-pipe, between the triple-valve piston and the cut-out cock, the reduction on the train-pipe side of the piston causing the application of the brakes. If the leak is found to be from the reservoir, it must come either from an imperfect fit of the seat of the slide-valve, or more probably from leakage past the narrow bridge that divides the reservoir and cylinder passage in the gasket between the triple-valve and the part of the apparatus to which it is attached, it being fastened to the *cylinder* head on passenger cars and directly to the *reservoir* on freight equipments

If the blow be from the train-pipe it is nearly always due to an imperfect seating of the emergency-valve (Plate 17, No. 10), the bearing face of which being rubber will sometimes rot out from the action of oil. In many cases a little dirt under this emergency-valve will cause a sharp blow out of the exhaust, and this can frequently be dislodged by a number of emergency applications of the brake, the rush of air into the cylinder blowing the dirt along with it.

Sometimes the blow can be stopped, simply by cutting out the car bleeding the reservoir, and then opening the cut-out cock suddenly

BLOW FROM EXHAUST—ENGINE AND TENDER TRIPLE.

In the triple shown in Plate 19 a blow from the exhaust is generally caused by a leak around the plug of the cut-out cock, and it can sometimes be stopped by simply turning the handle down and then up again If this does not help, the plug must be ground in.

STICKING AFTER EMERGENCY.

Brakes sometimes refuse to release promptly after an emergency application. If this "sticking" is accompanied by a violent blow from the exhaust when an attempt to release is made, it is a sure indication that the emergency-valve (Plate 17, No. 10) did not go back to its seat properly after the application, and something must be done to make it do so. Dirt lodging on the seat as described just above

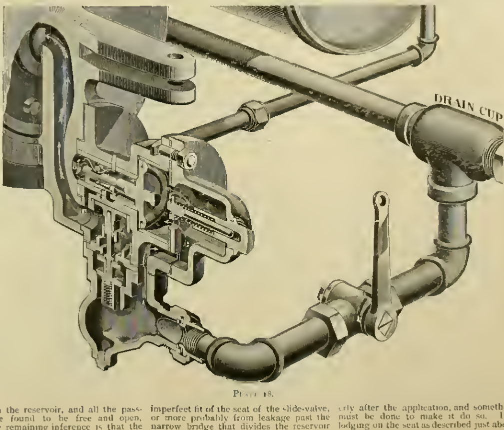


PLATE 18.

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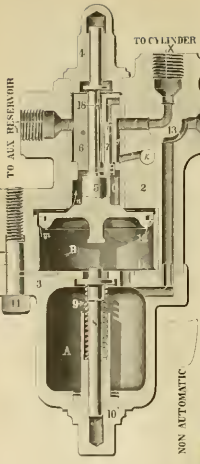


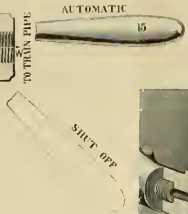


PLATE 19.

BRAKES SETTING WHILE RUNNING.

This is almost invariably an indication of a reduction of the pressure in the train-pipe, either through leakage, equalization (air flowing from a car having a high pressure to one having a less pressure), the separation of the train into two or more parts, or the bursting of a hose. I say *almost* invariably, because there are cases in which the brakes may set while running, without any reduction of the train-pipe pressure. For example, this sometimes occurs on a driver or tender brake as a result of leakage past the four-way cock plug (No. 13, Plate 19) may be the cause, or it may be some defect in the apparatus itself, such as the spring (No. 12, Plate 17) being broken or very weak, or some binding of the piston (8). The author has a very distinct recollection of one case, in which such trouble was caused by a piece of scale from the casting lodging above the piston (8), just large enough when it stood on edge to block the piston so low that the valve could not seat. Hard rapping on the valve case would shake it down flat and stop the blow, but the next emergency action would set it up again, causing it to stick as before. A careful examination on taking the valve apart revealed the cause of the disturbance.

If the brake sticks after emergency, but does not blow from the exhaust when the excess pressure is thrown against it, it is an indication that the main piston (No. 5, Plate 17) refuses to be forced back to normal position. This may be from frost or dirt, but in the great majority of cases will be found to be simply because the pressure put into the train-pipe is not yet high enough to overcome that in the reservoir. Bleeding the reservoir slightly should release it, but if it does not, then the blame may fairly be laid on the valve. It must be taken apart, thoroughly cleaned, and then put together again.

EMERGENCY ACTION WHEN NOT WANTED.

This may result from a very weak graduating-spring (Plate 17, No. 22), or a failure of graduating-valve (7) to unseat properly, either because the pin which controls it is broken, or else because it is surrounded with gum and dirt. It might also result in case the main piston (5) should stick just enough to require a very heavy reduction to move it. This is a very annoying and difficult trouble to locate. The first thing to do is, of course, to find out which triple-valve it is that is giving the trouble. This can best be done by stationing men along the train to watch the action of the brakes under the cars while the engineer makes an application. If the train is too long to be conveniently watched in this way, begin with the first half. If this by itself does not give the defective action complained of, it is a manifest fact that the offending triple-valve must be in the latter half of the train. A few careful tests of this nature will soon locate the car on which is the defective valve, and when so located it can be cut out until the repairer can fix it. The exact operation of a valve such as the one just above described is as follows. On the first light reduction in the train-pipe it will be the last to apply, and when it does set it will go on very violently, this quick action causing a full application of all the other brakes in the train.

ACCIDENTAL EMERGENCY APPLICATION.

If the setting of the brakes is sudden and violent, either one of the last two causes mentioned above is generally to blame, *i. e.*, either a hose has burst or the train has separated. Anything else, however, which would make a large and sudden reduction in the train-pipe would cause the same action, such as the opening of a conductor's valve or the blowing out of a plug, gasket or pipe fitting.

ACCIDENTAL SERVICE APPLICATION, OR "DRAGGING OF BRAKE."

This is one of the most frequent troubles that arise in the use of the automatic brake, and, as was stated before, is seldom the fault of the triple-valve. When it is once clearly understood that the brake is dragging, as a result of some reduction of pressure somewhere in the train-pipe, and that the triple-valve would not be doing its duty if it did not respond to this reduction, then a long step has been made towards locating the difficulty and remedying it. The first thing to do is to find out whether the reduction is due to equalization or leakage. If it is the former, a part of the train only will be affected, but if the latter, the trouble will be general throughout the train. In either case, careful handling of the engineer's valve will generally prevent any trouble or delay of a serious nature, as the brakes will cease to drag if the air is fed into the train-pipe as rapidly as it is leaking out, and if the head cars are not charged with a higher pressure than the rear ones when the breaks are released

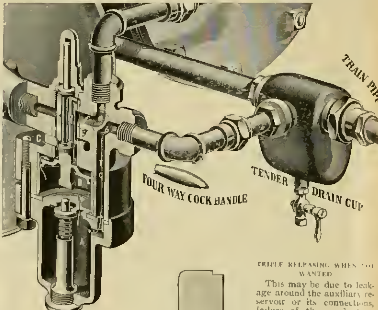


PLATE 20.

TRIPLE RELEASING WHEN NOT WANTED.

This may be due to leakage around the auxiliary reservoir or its connections, failure of the graduating-valve (No. 7, Plate 17) to seat tightly, increase of pressure in the train-pipe through leakage back from the main drum through engineer's valve, or a wave of pressure in the head end of the pipe when the exhaust is suddenly closed. The last named difficulty only occurs on long trains, and the third one generally on but one or two cars or the lone engine.

DRIVER BRAKE TRIPLE RELEASING.

The driver-brake is the one most apt to give trouble releasing when it should remain set, and this is for two reasons, or speaking more accurately, several reasons. First, being at the extreme head end of the train-pipe it is most sensitive to the wave of pressure caused by the closing of the engineer's valve exhaust; second, the cylinders are seldom, almost never, tight; third, the travel of the pistons is generally more than it should be; and fourth, the reservoir is often too small for the size of the cylinders. It may be asked by some, why the escape of excessive expansion of the air fed to the *cylinders* from the triple-valve should have such an effect on the action of the triple, when that action is supposed to be controlled by a piston balanced between *reservoir* and train-pipe pressure. All that I can say in reply to this is, that the greater freedom of expansion on most driver-brakes seems to make possible a heavier reduction in the reservoir during the short space of time in which the graduating valve remains open, so that the valve is left nearer the releasing point as regards pressure than is commonly the case. I have seen it demonstrated repeatedly by experience, that driver-brakes which caused trouble by releasing at the wrong time could be effectually cured by simply reducing the travel of the pistons, or putting on a larger reservoir.

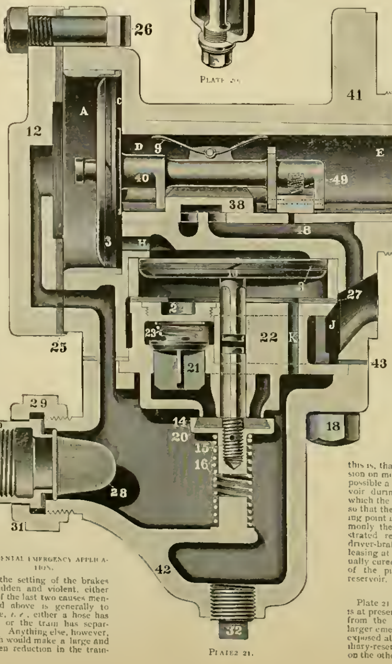


PLATE 21.

NEW YORK TRIPLE.

Plate 21 shows the New York triple that is at present in most general use. It differs from the Westinghouse in the use of a larger emergency piston, which is directly exposed at all times to pressure in the auxiliary-reservoir on one side and train-pipe on the other, and, further, in the use of a small slide-valve for a graduating-valve in place of the poppet-valve in the main slide-valve found in the Westinghouse. The general principle of operation is so similar as to permit of the use of the same general method of treatment as that given just above. Where the brake sticks after an emergency application, it is generally because the emergency-valve (20) and its piston (13) has not gone back to its seat after equalization. In this case, a heavy blow from the exhaust will show itself as soon as the train-pipe pressure is increased above that in the auxiliary-reservoirs, because, the emergency-valve being open the train-pipe pressure has direct communication with the cylinder, and as soon as the main piston and valve are moved to release position this pressure will find an escape through the exhaust. This action of the valve may be due either to the emergency piston being dirty or the spring (16) being broken or weak.

In case there is a constant blow from the exhaust port of this valve (or through the pressure retaining-valve, which amounts to the same thing) and still the brakes set and release properly, the first thing to do to locate the trouble is to determine in the manner previously described whether this blow comes from the train-pipe or auxiliary reservoir.

If the brake sets immediately on being cut out, indicating that it is train-pipe pressure that is escaping, the valve must be examined to see whether it is from dirt on the seat of the emergency valve (20) or an imperfect bearing of the gasket which forms the joint at (27).

If, on the contrary, the brake does not set when cut out, but the blow grows gradually fainter and finally dies out entirely, the bearing of the small slide valve (45) must be examined as also the gasket joint between the triple and the reservoir, as these two points are the one at which the reservoir pressure is most apt to escape.

Edison's Railroad Career.

All railroad men are more or less familiar with the name of the great electrician, Thomas Edison, but few of them are aware that he started out in life as a train-boy, and that he was a railroad operator for several years. The story of Edison's boyhood is very attractively told by Linda Rose McCabe in *St. Nicholas* for February.

He was born at Milan, on the Huron River, and his first work was that of train-boy on the Grand Trunk. In this humble position he was noted for his energy and ingenuity in devising means to advance his business. The first original enterprise he undertook was to wire the most startling headlines of the morning papers to the way-stations and get them posted in advance to induce people to buy papers. Then he started a small weekly paper called *The Grand Trunk Herald*, which he set up and printed in the baggage car. As far as we know, this was the first and only paper printed on a train.

The boy was fond of reading scientific books and was greatly attracted to natural science. His bent in this direction induced him to quit the position of train butcher and editor and turn telegraph operator. When he was still a boy and operated at Port Huron, Mich., an ice jam broke the telegraph cable in the river, and there was so much floating ice that no boat could cross. It was important to obtain communication with Sarnia on the other side, but there seemed no possibility of making any connection. In this emergency, Edison went to one of the switching locomotives and with the whistle began calling Sarnia by the telegraph code. After a time he was answered. The whistle has often been used to sound the telegraph signals since that time, but Edison first showed the way.

He drifted about for several years, working as an operator. When stationed at a station on the Great Western as night operator, he devised a rig which automatically reported his office signal at the required times, even when he was indulging in a nap. The train dispatcher was struck with Edison's regularity in reporting, but one night, needing to send a holding order the particularly punctual operator could not be roused, and his trick was discovered and the author was promptly discharged.

After that he found employment where his scientific attainments and inventive ability could be employed for useful purposes.

Don't Get Funny.

BY K. M'N. WELLS

Old Tom Bowen had seen a good many of his firemen set up, and always looked forward to that end with pleasure. He was in the habit of giving the young fellows plenty of advice, which they usually took with good grace, though sometimes Tom wasn't as choice of his language as he might have been. He was proud of his "boys," as he called them, and always took credit to himself for all their advancement and "good luck," but laid all their mistakes to "the cussedness that was born in 'em, that he couldn't educate out of 'em."

Old Tom was "Old Tom" to everybody, and no one intended disrespect to him by its use; in fact Tom himself considered it a compliment to his age and experience on the road.

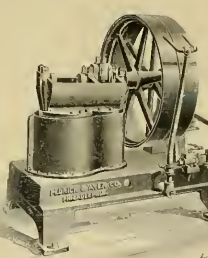
He always contended that you couldn't transform a fireman into an engineer by just putting him over on the right side, and that if you wanted a young fellow to do reasonably well when he was set up you must give him practice while he had a man to oversee his work, and show him "tricks and such." When Tom thought his fireman was far enough advanced in his education to be allowed to run the engine a little, he always read him a lecture, telling him, among other things, to be careful—not to be in a hurry—to be satisfied to see the wheels turn slowly at first, and to be sure of what he could do, and then do it, and he always ended his lecture by saying, forcibly "Above all things, boy, don't get funny."

Just before Tom's fireman, John O'Brien, was put to hostling, old Tom was letting him do some switching, when John forgot the "funny" part of the lecture he had heard, and broke a draw-bar. Old Tom's wrath broke bounds, and John got another lecture and a job lot of epithets he hadn't bargained for. When Tom cooled down he told John the story of a fireman he had had years ago, whose sad experience had been a lesson to many a man.

Says old Tom: "Do you remember that flagman at the A street crossing in Arlington who has both legs cut off below the knees?" John recalled him and Tom dryly remarked: "Well, he was one of the brightest fellows that ever fired for me. He hadn't a lazy bone in his body. He was always on time and eager to work; kept the engine as bright as the day she left the shop, and the cab as clean as a parlor. I felt my pride in him grow every day feeling sure he'd make a first-class man when they gave him an engine. The master mechanic thought so too, and gave him a job of hostling. For some time he seemed to remember all I had told him, and ran as any careful man would. But after a while his independence, and an irresistible desire he had to see the wheels go fast changed things, and the way he flew around the yard was a caution to the slower fellows, who were sure the switches were right before going ahead, but this fellow seemed to go on the plan that everybody knew he was coming and would get out of his way. If there was an engine to be turned back on short time, he was sent to catch her, and I guess his success in this line turned his head. Anyhow, his luck left him, for he had an experience one day that put him where he is now. He caught No. 3's engine, and although there was no hurry, he started for the roundhouse as if he was pulling the flyer out of town, and he failed to see a freight car coming toward him with a switch-engine behind it, until it was too late, when he reversed his engine and jumped. He fell across the next track, and before he could get up, a string of cars ran over him cutting off both legs below the knees."

Here Tom stopped speaking and as he recalled the picture of his old fireman picked up from the track, a bleeding wreck, and remembered the pitiful grief of the poor wife and children when he was taken home, and thought of their scanty home comforts now, his eyes filled with tears. The sight of Tom's emotion told John that there was a part of the sad history Tom had not told him, but his mind instinctively took up the same train of thought Tom was following, and he too saw the grief and woe in the poor man's family, and realized, for the first time in his life, that a man's duty is not only to himself but to those dependent on him, and he silently resolved that his carelessness should never bring sorrow up on his loved ones.

After a long silence old Tom's face began to brighten, and soon with a smile he said: "But you should have seen that engine when she was cleared of the car, which was loaded with bananas. If ever you saw a sight to make Dagos weep, it was the waste of those bananas. She was simply plastered with them from pilot to cab. The headlight, smokestack and sandbox were gone, and there was nothing to be seen but bananas, bananas, bananas."



COMPOUND AIR-COMPRESSOR.

A New Compound Air-Compressor for Shops.

The Pedrick & Ayer Co., of Philadelphia, Pa., have just put on the market a new belt-compressor for shops, shown in the accompanying illustration.

The machine is very compact, and has an automatic belt-shifter that keeps the pressure up within a fixed limit, when no air is being used, the compressor is at rest and not wearing itself out.

The large cylinder is 11 inches in diameter and delivers its air to the smaller cylinder, 6 inches in diameter. The cranks are set opposite each other, which insures quiet running.

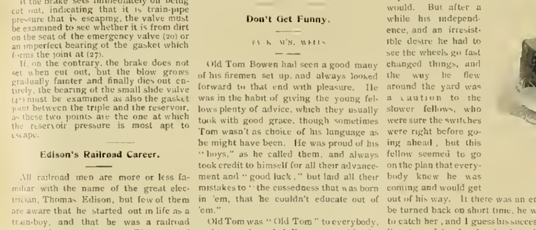
The air-valves are the usual gravity variety, and the cylinders are water-jacketed, this keeps them cool, but, of course, the jacket need not be used.

The machine can be run with good results up to as high as 160 revolutions per minute.

Strangely enough, the first of these compressors went to a railroad shop at Drontheim, Norway, where it is reported as very satisfactory.

It has a capacity of about 32 cubic feet free air per minute.

A Self-Feeding Tube Expander.



SELF-FEEDING TUBE EXPANDER.

We illustrate herewith a flue expander that has been in use for some three years at the D., L. & W. shops at Kingston, Pa., and is being put on the market by the Henry C. Ayer & Gleason Co., of Philadelphia.

The cuts make the construction plain. There are no end pivots, no casing nor screws. The rollers are loosely held in the ring by ball heads and a coil spring band. They project out from the ring without a case, and are entered in a tube at an angle to the line of the taper plug, by turning which they are forced into the flue tighter. When desired to release, the drift pin is turned backward. The drift pin is never hammered to get it in or out. This is a big improvement, as often as much damage was done to adjacent flue by hammering this wedge as the rolling did good to the leaky one.

? A. What You Want to Know. ? A.

Don't ask questions that simply require a little figuring to determine; make each question separate. No notice taken of anonymous questions.

(90) F. S. H., Mineral Point, O., asks

If an engine is running down grade and you reverse it and open the throttle, will the pistons pump air into the boiler against steam pressure or not? *A.*—Yes, if engine has sufficient momentum to keep running after there is a pressure on her pistons equal to her boiler pressure.

(91) W. B. A., Norwich, Conn., asks

1. What disposition has been made of the Boston & Providence engine "Daniel Nason," and the Baldwin express locomotive "Columbia," exhibited at the World's Fair, Chicago? *A.*—They are now in the hands of their owners. 2. Is it true, as reported in the papers, that the latter made two miles in a minute in a recent trial on the Baltimore & Ohio? *A.*—It is not true.

(92) E. B. M., Minneapolis, Minn., writes

In answer to B. N. Y. L., No. 87, you state that steam at 100 pounds pressure has 273 times the volume of the water. Is this a typographical error, or are Haswell and Roper both wrong? They give 295, a difference of 22 volumes. *A.*—The figures given were taken from Northcott's tables. The best steam tables ever worked out were by Charles T. Porter, the eminent steam engineer, who gives the specific volume of steam at 100 pounds absolute pressure (which would be 14.7 more than gauge pressure) at 267.9, which, reckoned from gauge pressure of 100 pounds, would give [illegible] volumes.

(93) G. S. H., Windsor, Ont., asks:

1. In Educational Chart No. 2, what is the object of running one pipe from pump to drum and another back from drum to engineer's valve, and so on to train line? Would not one pipe from pump extending both ways from a T, one end to drum, other end to engineer's valve and so through it to train line, do equally well if suitably drained, and save pipe? *A.*—When connected as you suggest the engineer's valve receives a great deal of water, oil and dirt collected by the pump, the pulsations of the pump make the handling of the valve very uneven and affects the action of the governor. The extra pipe amounts to nothing, and insures a cleaner valve and better braking.

(94) J. J. Jones, Hanover, Kan., writes

1. Why can a person skate over ice so thin that it would break almost instantly if the same person were to stand still on it? *A.*—Thin ice may be crossed quickly because it is supported by the water, which is quite dense, and moves from under the ice and the skater slowly. The ice and water do not have time to get out from under him. 2. How can you get a 75-ton engine over a bridge constructed to carry only a 50-ton engine? *A.*—Strengthen the bridge. These questions are doubtless raised by one who believes the common fallacy that an engine running very fast over a bridge does not put the pressure upon the structure due to the full weight of the engine. Exact engineering measurements have proved that there is nothing in this theory.

(95) J. R., Grand Rapids, Mich., writes

In running different engines I notice that injectors placed about on a level with the top of tank run with less noise, have greater range, start quicker, not so liable to break as those high up on boiler. Now is not the velocity greater when the lift is 1 foot than it is at 25 feet? If velocity, vacuum and steam pressure are the main points in the successful working injector, why place it so high. If it takes all the power to raise water say twenty-five feet, what's left to force it in boiler? And this climbing up and down every time to start or stop it is not pleasant. *A.*—A whole chapter might well be written on the outrageously unhandy location of injectors; they ought to be so located that a runner could handle them without even taking his head inside the window, let alone getting off his seat. Every inch of extra lift decreases the capacity of any injector, and adds a straw to the load of possible failure, affects the range, and causes the instrument to make more noise.

(96) S. G., Fall River, Mass., writes

What is the answer to questions 14, 21, 23 and 25, Chart No. 1? *A.*—Question 14 reads: "How would you place piston and valve if disconnecting a mogul or ten-wheeler, where side rod pin would strike cross-head key if it was blocked in center of guides?" This was put in to call attention to an often forgotten point. The answer is obvious. If the front side rod pin struck the key when cross head was in the center, it would be necessary to block the cross-head forward or back, and if forward move the valve forward, and *vice versa*, the pin might strike the key if it was forward or back, this point should always be observed. Question 23 reads "What could happen that would cause you to disconnect without covering the ports?" We will answer this by asking another. What good would it do to cover the ports if the steam chest cover was broken? Question 25 reads "Does it (the piston) stop at each stroke? When?" Yes, the piston stops at each end of the stroke.

(97) M. T., Port Jervis, N. Y., writes

There is a difference of opinion between different parties in this vicinity as to the construction of a deck engine and a foot-board engine. Please advise in your next issue how a foot-board engine is constructed, and also how a deck engine is constructed. *A.*—We do not know that there is an established rule in this matter. In Europe the platform behind the boiler-head (in this country called a "deck") is called a foot-plate. In this country the word "foot-board" was once used to designate the same thing, and some still call the "running-boards" ahead of the cab, foot-boards. If we were the court of last resort in this case (which we are not) we should say that an engine having the boiler extending through the cab and where the engineer and fireman stand on an extension of the running-board, which becomes the cab-floor, was a "foot-board" engine, and one with a short boiler-head and an open deck between the men and back of the boiler-head (like the ordinary soft coal eight-wheeler), a "deck" engine.

(98) S. G., Fall River, Mass., writes

1. Am running a mogul, drivers are equalized to front truck by usual long equalizer with a hanger coming from back up to a cross lever between the ends of the front driver springs. Should I break this long equalizer or center-pin of pony truck, how should I block up? *A.*—Raise engine in front and block between the cross equalizer and the boiler, or between the long equalizer to truck and the cylinder saddle. 2. If truck wheels are solid cast iron plate wheels, and I break out a piece or a piece of flange, how can I block wheel to slide? *A.*—This is a case for horse sense and judgment. Probably by blocking a piece of wood or a tie between the broken piece and the frame, or some other stationary part of the truck. 3. What kind of a clamp would you recommend for holding disconnected valve stem where metallic packing is used? *A.*—A strip of iron 1½ inches wide, ¼ inch thick, with a slot in it for the key, and carried back, bent and punched to go over one or both of the gland studs. It must be the right length to hold the valve in the center of the face of the seat.

The Air-Brake Situation.

A circular has been issued by the Westinghouse Air-Brake Co. on "The Air-Brake Situation." The circular deals principally with the renewed efforts of the New York Air-Brake Co. to place an air brake upon the market after being defeated in the courts for infringement of the Westinghouse patents. The Westinghouse Air-Brake Co. claim that it is entitled to the exclusive manufacture and sale of quick-acting automatic air-brakes and brake material, and that it is advantageous to the railway companies to purchase exclusively from it in order that there may be only one class of apparatus to maintain. The company further believes that if brakes and repair parts were to be made indiscriminately by a number of manufacturers, there would be increased risk of accident, and that the money heretofore expended for air-brake equipment would be greatly jeopardized.

To the Railway Supply Fraternity.

GENTLEMEN—As your Standing Committee, we feel called upon to direct your attention to a matter of great importance in connection with the coming convention. You have already been fully advised that in connection with the Committees of the Master Car Builders' and Master Mechanics' Associations, your Committee have secured a rate of three dollars ($3) per day each, at Congress Hall. It being obvious to all that Mr. Clements, the proprietor of Congress Hall, must open his hotel in advance of the regular season to accommodate us. He consented to do this with the full understanding that he was to have the entire patronage of those attending the convention, and we think it very desirable that *all* our fraternity should contribute their part toward carrying out our part of the agreement. Unless we are faithful to these pledges, it will be difficult in the future to effect such favorable arrangements, or induce desirable hotels to open for our especial accommodation. We beg, therefore, that you will promptly secure your rooms.

W. D. DRAKE,
J. H. SEWALL,
T. R. FREEMAN,
A. G. RICHARDSON,
F. W. COOLBAUGH, *Chairman*,
Standing Committee.

We Saved His Life.

One of our subscribers away out in California puts the following Bill Nye P. S. to a letter:

"If you can't send me that chart please let me know it and I will commit suicide, because life is not worth living without that chart and LOCOMOTIVE ENGINEERING. I came near dying while I was waiting for the answer to my subscription."

William C. Baker, of New York, the well-known Baker heater manufacturer, has issued a new illustrated catalogue, showing the most recent form of heater now used for surface cars. An important feature about this catalogue is that it gives very detailed directions about how to erect the heaters, how to prevent them from freezing, and how to manage them after they are in use. The book contains a great deal of valuable information which trainmen in charge of car heating ought to learn. It would be a good plan for railroad companies to copy the most important parts of this catalogue and put it in the form of a book of instructions for their trainmen.

The Water Circulating Grate Co., of Philadelphia, is reported to be meeting with great success with the grate they have put upon the market. Its use has principally been confined to stationary boilers, but a modification has been adopted suitable for locomotives, and the expectation is that it will soon be tried in locomotive fire-boxes.

The many friends of Mr. G. S. Woolman, so many years engaged in the scientific instrument business at 116 Fulton street, New York, will be interested to learn of a very important change in his affairs. The firm of Queen & Co., of Philadelphia, with whom he was connected earlier in life, having found it necessary, owing to the great volume of their business in the vicinity of New York, to establish a branch there, have purchased Mr. Woolman's entire business and have secured his services as their New York manager. From the Philadelphia staff of the electrical department, Mr. O. T. Louis, formerly in charge of resistance standardization in Queen & Co.'s laboratory at Ardmore, has been detached and stationed at the New York office. The establishment of this New York branch will be a great convenience to the many customers of Queen & Co. in New York and will undoubtedly result in largely increasing their already extensive business in that vicinity.

We cannot understand why the M. C. B. Association does not repeal the clauses added to No. 8 of the Interchange Rules two years ago, making owners of cars responsible for brake shoes and journal bearings renewed while the cars are away from home. Keeping account of these renewals causes more extra clerical labor than the parts are worth. It worked quite equitably for every railroad company to put in brake shoes and brasses when necessary on any car passing over their lines. Why the practice should have been changed is hard to understand. The existing practice gives the unscrupulous man a steady advantage over those who are trying to act fairly towards connecting lines.

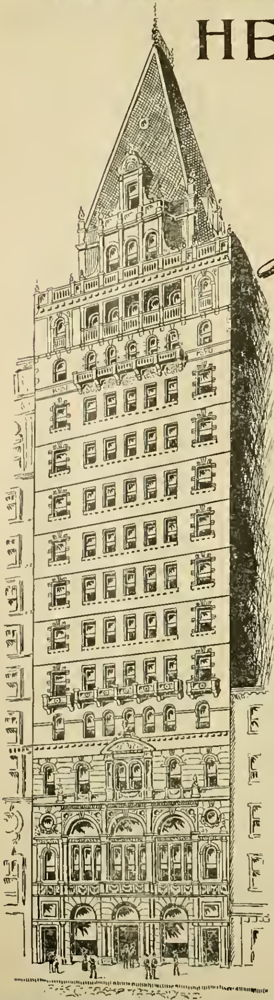
A new illustrated catalogue has been issued by the Rue Manufacturing Co., of Philadelphia, showing their well-known "Little Giant" injector, their boiler-washer and other boiler-feeding appliances made by the company. Besides showing very clearly the different forms of apparatus manufactured, the catalogue gives a great deal of valuable information about injectors and their connections. The catalogue will be found convenient as a reference when anything is the matter with an injector, or it is necessary to order any particular part.

Watson & Stillman, makers of hydraulic machinery, New York, have issued a new catalogue, showing the latest forms of apparatus which they make. Their product is by no means confined to hydraulic machinery, as they appear to make everything required for lifting or moving heavy articles. Among the things illustrated are an electric motor lift, a portable double screw hoist, traversing jack, three roller adjustable tube expander, and various other articles used in machine shops.

A new illustrated catalogue of their air-brake, air-signals, and other appliances, has been issued by the Westinghouse Air-Brake Co. It is got out in admirable shape, the engravings being of the highest line of this art, all parts being named and numbered as they have been in previous catalogues. This catalogue is much fuller than any of the previous ones and appears to contain illustrations of every detail of brakes and air-signals.

The Hall Signal Company has brought suit in the United States Circuit Court of Western Pennsylvania against the Union Switch & Signal Co., of Swissvale, Pa., for alleged infringement of their United States patent covering their improved Anti-Lightning relay and circuit.

The committees of the M. C. B. and M. M. Associations request that members attending the Saratoga meeting bring their button badges.



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Automatic Freight Car Coupler.

New York Office, . . . 120 Broadway.
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GOULD Coupler Co.

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Locomotive and Car Axles, - - Coupling Links and Pins.

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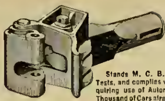

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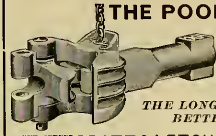
Stands M. C. B. Tests, and complies with U. S. law, requiring use of Automatic Car Couplers on and after January 1st, 1898. Thousand of Cars already equipped. Capacity of Works, 200 Couplers per day.

ST. LOUIS CAR COUPLER CO., St. Louis, U. S. A.

THE POOLEY COUPLER.

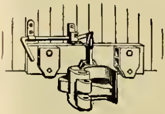


POSITIVELY AUTOMATIC.

Made from the Best Material.

THE LONGER IN SERVICE THE BETTER IT OPERATES.

MANUFACTURED BY PRATT & LETCHWORTH, Buffalo, N. Y.



THE SMILLIE COUPLER is the Strongest and Simplest M. C. B. Coupler.

Only 4 Pieces.

Tensile Strength (Fairbank's Test) 139,640. Drop Test, 709 lbs. hammer dropped 18 ft. 22 times failed to break the knuckle.

ALL LOCKING PARTS ARE THE BEST OF STEEL.

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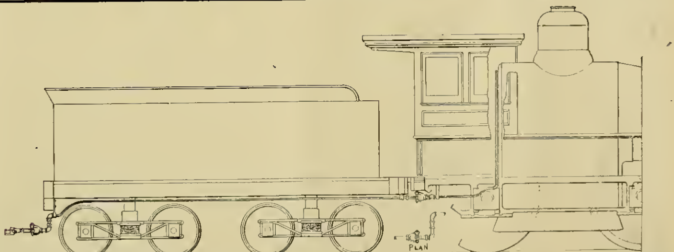

THE HAMPSON FLEXIBLE STEAM JOINT

Does away entirely with Rubber Hose for Steam Heating.

HAS NO GROUND JOINTS.

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215 FRANKLIN STREET, BOSTON.

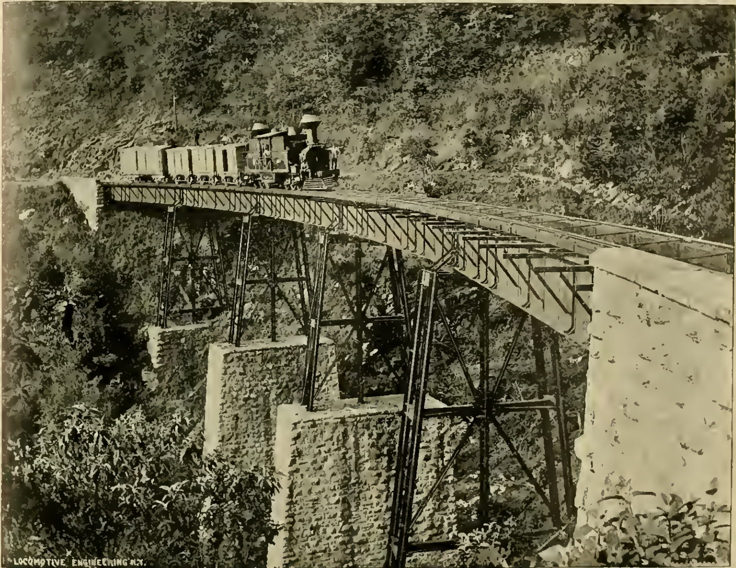
OUR ENGRAVINGS.

Of late we have had a great many inquiries as to who made the fine half-tone plates shown each month in LOCOMOTIVE ENGINEERING. Credit is due the expert anywhere and we are glad to recommend the engravers of our plates to those wanting good work at reasonable prices. All the half-tones and reproductions we use are made by the STAR ENGRAVING & PRINTING CO., 607 & 609 Sansom St., Philadelphia, Pa. SINCLAIR & HILL.

Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock.

VOL. VII, No. 7. NEW YORK, JULY, 1894. 20 Cts. Monthly / $2.00 Per Year.



Viaduct of Wimer, Mexican Railway. Fairlie Engine, for Heavy Grade.

A Trip in Old Mexico.

[EDITORIAL CORRESPONDENCE.]

NOTES ON THE MEXICAN RAILWAY

I hit the City of Mexico "in edge of the dark," as the natives describe the twilight, and as the National station is a mile or more from the hotels, I arranged with the conductor to bargain with a hack driver to get me safe into a hotel where they could talk English. I landed all right at the Guardiola (pronounced "Wad-e-ola"), a pleasant hotel, as Mexican hotels go, no place to eat, but fairly nice rooms with single beds and good attendance. There is no temptation to a weak soul in a Mexican hotel, no bar, and all the chambermaids in Mexico are "he" ones and they are not overly attractive in dress or appearance. You rustle grub wherever you can, and have the choice of American, Chinese, French or Mexican restaurants. The French are high-priced and pretty good; of the ordinary ones the Chinaman is in the lead.

In no Mexican hotel will you find a parlor or waiting-room. They are hollow, square structures, with a covered court or open garden in the center, with interior porches on all four of the inside walls.

The City of Mexico is built in a pocket or low spot in the mountains—the worst place to drain they could possibly have found within a hundred miles. A large lake a couple of miles away on the south is some six feet higher than the city. It is a very shallow body of water, the shores being acres and acres of mud, so impregnated with salts, alkali, soda, etc., that nothing will grow on them.

Sewage goes through open canals, or rather goes into them; there appears to be no "go" to it, these canals being full of green slime. Nothing but the heavenly climate of this altitude prevents the maintenance here of a perpetual pestilence.

The city is on nearly level ground, the streets as a rule are narrow, and all have churches, great and small.

Stone is the principal building material, the streets are well paved, and there is fairly good water.

Splendid little parks are located all through the city, and the suburbs are full of nice resorts, gardens, etc.

The street cars are hauled by mules, and when a suburban car gets out of a crowded part of the city, the driver blows on a brass horn, lights his cigarette, and setting his mules at a run, makes electric car time to the destination; it's the liveliest mule and the liveliest move you will find in Mexico.

Every railroad running out of the city has a depot of its own, and they are all located at a considerable distance from the center of the city. A union depot is badly needed.

Of course, there is no end of interesting things to see in the capital—the Museum, the Cathedral, the Castle of Chapultepec, National Pawnshop and the plazas—but the most of all, the people. But we are after railroads, and will take a trip south to Vera Cruz over the

MEXICAN RAILWAY,

popularly known as the Vera Cruz road. This is an English company (limited), and the road is the oldest in the republic.

It was commenced in 1858, but the ups and downs of Mexican politics kept it back, and it was not completed through from the seaport to the city until in January, 1873, when it was opened by the then President.

It's a curious fact that none of the roads ever built "in" to the City of Mexico, every last one of them hauled iron, locomotives and cars in and built out. I was told that this was a law; it is at least an established custom.

As the coast country is hot and the upper end of the line very dusty, Rinckle and I prepared for it. He appeared at the Mexican Railway depot in a linen duster and a smile, and I laid aside my hard-boiled shirt for what the native merchant assured me was the proper thing—a French "traveling shirt." This was a gorgeous-figured affair of soft goods, something on the order of an outing shirt. As it was intended to sleep in as well as to ride in, it was cut very long for a shirt and a trifle short for a train—when I got it on I looked just like the plaster figure of St John that stood on a building across from my room But everything goes in Mexico

We ate a pair of hot dough-gods of some kind and poured down a couple of cups of coffee, just about hot enough to scald hogs, and then pre-empting two seats in an American coach with our grips, we went up ahead to see what kind of a "mecanna" was going to pull us.

Station of Mexican Railway, City of Mexico

We found a large, road connected, eight wheeler, built by Dubs & Co., at Glasgow, Scotland She had 17½x24 inch cylinders and 6-foot drivers, a typical English machine.

The "mecanisto" was a native, and was busy slopping oil on the bearings, awful good oil and lots of it

There are some English cars still in existence on this road, but not many There was an officer's private car on the rear of the train, this was an English carriage with side doors, etc , but all in one room, such as they call a saloon car in Europe.

For the regular service the road uses American cars, everything being equipped with the Westinghouse brake.

The line is pretty straight and nearly level out of the city, and our 6-foot wheel got a fifty-mile an-hour swing on us inside of two miles, and kept it up to the first stop—where we killed ten or fifteen minutes. This is typical of all the Mexican roads , long time at stations, time to get a drink, see a friend, roll a cigarette or buy "pulque " coffee or some of the many liver pads made of red peppers and corn-meal that the peon women offer at every station

The road runs northeast out of the city, passing the church and shrine of Guadalupe, the patron saint of Mexico, and passing between the lakes Texcoco, and San Cristobal, across the great canal that is being built to drain the valley , the ground is nearly level for miles, the road passing through miles of agave plantations

All through the country you will notice crosses and crucifixes on straw stacks, posts, buildings, etc. The average Mexican will steal a red-hot stove under any and all circumstances save one—if it has a cross on it.

On the plains of Ampan the road turns to the southeast, passing well to the east of the extinct volcanoes Popocatepetl and Ixtaccihuatl. At Apizaco we got a good meal , here the branch runs to Puebla, the second city of importance in the republic. On this branch is the town of Tlaxcala, where the first Christian church on the American continent was built. The grade is slightly up now, the hills more abrupt, and at a point a few miles south of Apizaco the altitude reaches 8,333 feet above the mid-tide of the Gulf.

The line constantly approaches the base of the great snow-clad peak of Orizaba, the highest in the country, 17,000 feet, until we reach Esperanza, where we traded our eight-wheeler for a Fairlie double-ender, and start down the mountain over a grade of 4 per cent , with curves of 350 feet radius

For ten miles the scenery is simply magnificent, the like does not exist anywhere. The train is on a shelf away up on the mountain side, and 2,000 feet below and almost under it is a perfect map, a green valley with fields, river, towns and farms, one almost feels like trying to throw a stone at the church in the little Indian town of Maltrata below.

As the train stops, women crowd around to sell fruit, such as one has never seen or tasted before When the train starts, so do the fruit venders, across and direct to the station below, and when the train emerges from the last tunnel and stops at the station, six and a half miles below, in the valley, there are your self-same fruit venders

At Orizaba we leave the double-ender and take a Baldwin ten-wheeler. There are twenty minutes to spare, and we take a hurried run through the shops. These are quite extensive, the machinery being about half English and half American

The service calls for some modifications in machinery, and all men we talked to, on this or any other road, spoke in the highest terms of the big double-ended Fairlies employed on the hill, especially after General Master Mechanic Mantie has overhauled and "Americanized" them. Mr. Mantie is a Pennsylvanian has been a long time in Mexico, and knows the needs of the lines. He is hampered more or less as is every other master mechanic in Mexico who works for an English corporation—by some "consulting engineer" in England, to whom the officers of the company refer everything , and as the said consulting engineer has never had any experience out of Great Britain, and must show his ability somehow, he "designs" things for the colonies—*don't cher know!*

I did not see Mr Mantie, he was out on the road, but my guide knew the engineer, and we were invited to *ride ahead.*

Out of Orizaba the road follows the river Blanco and, a short distance below the town, goes through a wild cañon, crossing a bridge 140 feet high and known as the "Puente Infernillo —Bridge of the Little Hell

Below, the line falls steadily, and tropical vegetation, tropical dress and tropical houses are seen. This is the coffee, mango, banana and cocoanut country.

I noticed that the fireman did all the oiling, and used plenty of it. The drops in the Nathan lubricator were chasing each other through the tubes, and when I spoke about it the engineer hurried them a little more

This company, as well as the Interoceanic and the Southern, believe that oil is the cheapest and best thing they can use for many purposes, and would rather buy ten quarts of oil a trip for one pin than have it cut. They fine an engineer $20 for burning and breaking an eccentric strap $10 for cutting a main pin or a set of guides, $5 for burning off an eccentric-blade pin or other small pins of the motion work. For this division of eighty-two miles the runners are allowed thirty pounds of lubricating oil, and can draw all of it in valve oil if they wish—and no questions asked—the only time a row is raised is when there is something hot.

Cordoba is a great coffee, tobacco and fruit place. In June and July you can buy mango manillas for $1.50 a gross, and pineapples at one cent each at wholesale

From here on the country is purely tropical, and near the coast line sand is abundant—around Vera Cruz it drifts like snow

The conductor of our train was a native educated in the United States. He was very kind and attentive, pointing out places of interest, etc.

All the switches are common ground switches with weighted lever, *and there is a man on every one of them.* If a yard has thirty switches there are thirty switch tenders. Men are cheap, watchmen in the mountain section are almost in sight of each other. These peon switch-tenders wear blankets, most of them being any color so that it's red, and until one becomes accustomed to it it should call for many unnecessary stops.

Here, as on most other roads in the country, they have tried to do something with their old rails , there being absolutely no market for them. The station grounds are fenced with old rails. Freight platforms are made of them. Good bridges are also constructed of rails. Wood racks, skids, hitching posts and many other things are constructed of this material, and it answers the purpose very well indeed.

One of the queerest practices is that every station platform is built on a side

Bridge and Tunnel of The Little Hell, Mexican Railway.

track instead of the main line, and all passenger trains go into and out of a siding at each station.

Trains are not numerous, and are run by the block system, without blocks. This is known as the telegraph block system and resembles a telegraph system where clearances only are given. The "orders" are little blanks (one color for trains going north another color for south-bound.) These are given from station to station, sometimes on passenger trains a clearance ticket is given to a point several stations away When a train is to be met, they write in the margin "X train to at —," they use the word "Cross" for meet or pass and abbreviate it by a simple X.

The engineers get $155 per month, work or play. Some of the English runners, who came out under contract ten years ago, get ten pounds ($50) of this in English gold, making their pay about $200 per month

The road is unfenced and many cattle are killed, and once in a while a peon. On some of the Mexican roads it's a jail job to kill a man, but this road stands well with the government, and its men are never molested for picking up a drunken man, and they don't pay for stock—or stop for it, either.

The Mexican Road is a standard-gauge road, the roadbed is excellent, many steel ties being used. The bridges are exceptionally massive and solid, and there are lots of them. A trip over this line should never be missed by anyone who ever goes to Mexico.

We arrived at the Gulf just after dark and walked to the Hotel de las Diligencias, opposite the Plaza and the Cathedral, and those horrible, everlasting bells, bells, bells!

In the next issue I shall tell you of my trip over the Interoceanic from Vera Cruz to Mexico City, and thence to El Paso over the Central, thus bringing to a close these already long drawn out notes on the land of Montezuma.

J. A. H.

The Benjamin, Altha & Illinworth Co., Newark, N. J., are making a specialty of the manufacture of steel casting for knuckles of M. C. B. couplers.

Station of Orizaba. Engine Running Shed on Left.

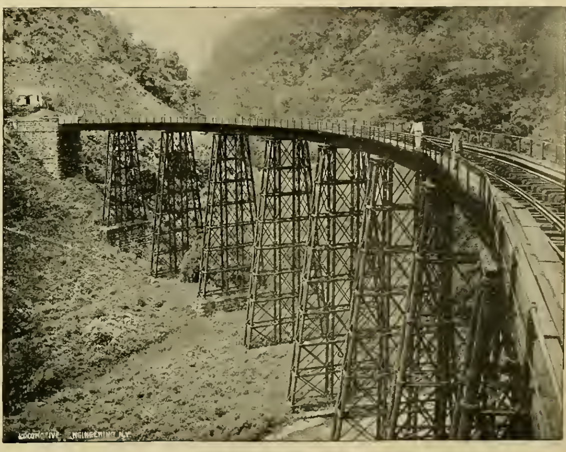
The Elementary Electric Battery.

Some time ago Mr. James W. See, the author of "Chordal's Letters," the most interesting mechanical book ever written, delivered a lecture on "The Application of Electricity to the Arts," which contains much information related in the elementary, comprehensible manner for which the author is famous. His elementary battery is thus described

"Imagine a ditch reaching from St. Louis to Boston, filled with a mixture of acid and water. Into the Boston end, we drop one end of a zinc wire, which we stretch overland till the other end is within our reach in Cincinnati. Into the St. Louis end, we drop the end of a copper wire leading also to Cincinnati. We have one end of a zinc and one end of a copper wire, which we tie together. Such an arrangement constitutes an electric current. The trench is a simple galvanic battery. When we tied our wires we developed that indescribable something called electricity. Something is going on over the whole length of our wire, and through the whole length of our ditch. The mysterious electric current is passing over the wire from St. Louis to Boston, and through the liquid in the ditch from Boston to St Louis. We feel nothing in the wire and see nothing in the ditch; but we can make the current appreciable to our senses. We untie the wires, and the current instantly ceases. We bring the ends near each other, and an electric spark flashes from the copper to the zinc wire. Electricity leaped the space between the wires and we saw it. We place a finger between the ends of the wire, the passing current produces sharp, stinging, nervous shocks of pain—we have felt it. * * * *

"You understand that our ditch, which we must never let out of our minds, is a battery. You will understand that the ditch, instead of being 1,800 miles long, might be 18 inches and still produce the same effect."

After describing a great many of the wonderful uses this electric current is applied to, Mr. See continues: "We take our copper and zinc wires, and dip them in a vessel of water. The current passes from the zinc to the copper through the water, for water is a conductor of electricity. Instead of water, we put acid into the vessel and then we drop in a gold dollar. The acid dissolves the gold and we have a clear colored gold solution. We drop in our wires, and we find that the current not only passes from the zinc to the copper wire, but that in its passage it picks up all our dissolved gold and deposits it upon the zinc wire in a perfectly uniform skin. Lifting out our zinc wire, we find it beautifully electro-plated If we tie a tin tea kettle on the end of the zinc wire and drop it into our vessel, we can deposit the gold upon the kettle instead of upon the zinc wire. This consti-



Cast Iron Bridge, Barranca de Metlac, Curve of 325 Feet Radius, Mexican Railway tutes the general art of electro-plating. Any metal may be deposited the same as gold. * * * *

"Table services of hard nickel composition, heavily electro-plated with pure silver are stronger and more serviceable than solid ware and vastly cheaper. This art permits strength to be combined with beauty, and allows us to use two metals for a base, which can be worked upon with more facility than the nobler metals. Nickel-plating on brass gives us an exterior surface unaffected by most acids, and at the same time of such hardness as to

Station of Apizaco, Mexican Railway.

retain its brilliancy. In the printer's art the electro-plating operations are of great value. The engraver draws and cuts his picture upon boxwood blocks. The process is slow and very expensive. If the block is used to print from it soon wears out, and new ones would have to be made at the same expense. Instead of using these blocks, the electrotyper is called into service and he takes the finished block and makes a wax mold from it. This mold he dusts with black lead so as to make it a conductor of electricity. He then hangs it upon his zinc wire in a solution of copper. He soon has a thin coating of copper which he removes. This shell is filled with type metal and it becomes the electrotype from which most pictures are printed."

Draft Appliances.

One of the most valuable reports ever submitted to an engineering society was that presented to the Railway Master Mechanics' Association on "Exhaust Nozzles and Steam Passages," by the committee of which Robert Quayle was chairman. The report is not of so much consequence in itself as it is for the evidence given that the committee had labored successfully to devise apparatus of an original character which can be employed in obtaining information of a highly important character. Nothing about the design of a locomotive exerts influence on the economical operation of the engine to the same extent as the draft appliances, and yet the best form of exhaust, smokebox arrangement, and form and size of smokestack, have been regulated more by whimsical preferences than by accurate demonstration of what was calculated to produce the requisite draft with the lowest exhaust steam pressure. This has not been due to any indifference regarding the importance of the subject, but to the almost insuperable difficulties encountered by those who attempted to investigate the relative value of different arrangements of draft appliances by experiments on road engines. Three years ago, an admirable report on "Draft Appliances," prepared by Mr. C. F. Thomas and Mr. A. W. Gibbs, was presented to the Master Mechanics' Convention. That report gave the records of careful original investigations with road engines, and the work done formed a very valuable beginning for the more comprehensive work done this year.

The great difficulty in coming to accurate conclusions, based on investigations made with road engines, is due to the variables that come up caused by the ever-changing conditions of road service. It has been customary for investigators of draft appliances to collect all the facts they could obtain and finish up by guessing at the others. The last committee appeared to understand very well the usual process, for they began by saying: "No satisfactory conclusions can be arrived at on this important subject by obtaining one good result from the many important factors connected with it, and guess at the rest. The man who thinks this subject is one easy of solution will, by a short time of wrestling with it, convince himself that the variables are legion, and that the obstacles presented are not much unlike the man who falls over a wheelbarrow—it presents a new and different obstacle every time it turns over."

In order to put themselves in a position to control the variables, the committee proceeded to arrange the carrying out of tests that would be no more subject to variables than the tests of a stationary engine plant. They made arrangements to carry out tests on the experimental locomotive plant at Purdue University, and when that was burned down Mr. Quayle, chairman of the committee, courageously set about erecting an experimental plant at his own shops. He demonstrated that a plant, with supporting rollers, on which a locomotive could be run at ordinary train speeds, could be created at small expense. We believe that the outcome of this plant will be the erecting of similar apparatus in connection with all large railroad shops. Mr. Quayle made excellent carrying rollers by turning the flange off worn out steel tired wheels. Nearly all the other parts employed in the plant were drawn from the company's store or the scrap heap.

Aqueduct of Belem, City of Mexico.

The means for running an engine at full speed on rollers being provided, a variety of special apparatus was prepared to use in the tests. Foremost among these was a special form of exhaust pipe which has a partition that can be raised or lowered while the engine is working. In connection with this was a highly ingenious device for measuring the angle of the exhaust steam. The engine experimented with has an extension front end. The committee tested the value of this arrangement by applying a partition which provided the means of cutting out part of the extension front. By moving this partition, they found that the best results could be obtained with a short smokebox, or at least one much shorter than the style which is now the prevailing fashion. Various tests were made with different sizes of exhaust nozzles set in different positions, with different forms and sizes of smokestacks, and with varied arrangements of the whole draft-regulating appliances. The results were very edifying, but want of time to make the tests more exhaustive prevented the report from being complete. The work will be continued for another year, when we can safely predict that a report will be presented which will do much to settle the best proportions and arrangement of draft appliances.

Watching the Working of "Discipline Without Punishment."

Last month a party of railroad officers and other friends of Superintendent Brown, of the Fall Brook Railroad, went on a trip over the line to examine the practical working of the system made famous through the article published in our February issue on "Discipline Without Punishment." The party was taken by special train from Corning to Williamsport and back in one day, and the following day from Corning to Lyons and return, the latter trip including a run over a branch which leads through a most romantic lake region.

The Fall Brook Railroad is devoted principally to the transportation of coal, and it is remarkably well equipped for doing the work efficiently at low cost. The permanent structure is excellent, heavy rails and rock ballast being used on the greater part of the main line. The numerous bridges are of steel, built on solid masonry, and there are numerous stone culverts and solid stone walls for the protection of the track from freshets and floods. Station houses are all substantial-looking buildings, and the siding accommodation is unusually good. Every place where trains stop is protected by signals, that are operated by men who seem to be strictly ruled by the discipline for which the road is noted.

From Corning south the track follows the bed of rivers that run into the Susquehanna, and it passes through some of the most striking mountain scenery to be found in Pennsylvania. For the greater part of the way huge pine-covered mountains rise from each side of the ravines followed by the track, and sometimes a part of a mountain slides down and pushes the track into a line of curvature not designed by the engineers. An active lumbering business is carried on at each side of the track, and the operation of getting the logs down to the river sometimes makes it exciting for the railroad men. They slide the logs down the mountain sides, which vary from the perpendicular to an angle of about 45 degrees. When a log travels three or four thousand feet on a grade of this kind it is apt to have its own way, even railroad trains receiving scant respect. One day an errant log found the box car of a passing train in its way, but it did not stop, it went right through the car and kept chasing along, and so did the train, for the car seemed hardly to feel the shock.

There are several logging railroads that branch off from the Fall Brook line and climb up to the mountain tops by grades worthy of the Rocky Mountains. The party went up one end of these roads, the Oregon & Texas, on a flat car pushed by a Shay locomotive. All these logging roads are operated by Shay locomotives and they are said to be remarkably efficient. It may be mentioned that a Shay locomotive has three cylinders set vertically at the side of the firebox, with connections that turn a shaft running lengthwise of the engine at the level of the axles. This shaft carries cogs which engage with gearing on the engine and tender wheels, and thus transmit the power. A Shay engine does not look as if it would make much of a record on speed, but the machine that pushed us along rattled down that mountain side at a gait which made the ears of one of the party turn white. This engine has been at work for four years, and has received no repairs beyond the work done by the engineer. The tires look as good as when they were put on.

The mountain part of this road is devoted strictly to business. There are numerous industries engaged converting

BRIDGE OF THE ATOYAC. NATIONAL HIGHWAY BRIDGE BEYOND.

wood into various marketable products, which give, with the raw lumber, a good business to the road, and the freight rates are not subject to the slashing of competitors. A great part of the region is a wilderness. In one district where the railroad runs, there is not a country road for eighteen miles. Yet there are people

CASTLE OF CHAPULTEPEC, THE WHITE HOUSE OF MEXICO.

living there. There are numerous clear mountain streams that swarm with trout. But no visitors try to catch them. We commend the attractions of this region to scribes and others in want of a quiet rest.

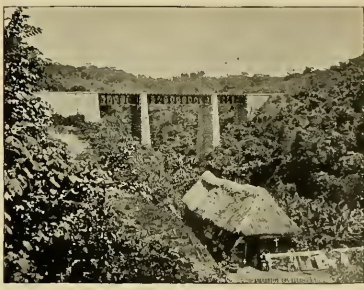
The part of the road north of Corning is of a different character. It passes through some of the most fertile country in New York State, and permits passengers to look upon some of the finest sylvan scenes for which the Empire State is famous. Shortly after leaving Corning, we cross the famous Watkins Glen on a bridge three hundred feet high, then we run for forty miles along the shore of Lake Geneva, the finest lake east of Erie. Branching off on an exploring trip, we see too many lakes for enumeration, and find them fringed with varieties of verdure that make up scenes wonderfully attractive.

While the party appeared on pleasure bent, business was not neglected, and the railroad men of the party were watching keenly the way that trains were handled, and the manner in which the men did their work. All acknowledged that the performances were perfect, and all admiration was expressed for the discipline which brought forth such good results. The remark was made by a Western superintendent "You have a better class of men than we can hire." This may be the case, but we are inclined to think that the treatment accorded works out the process of natural selection. When Mr. Brown's system of "discipline without punishment" becomes more general, we feel certain that the results will be the same wherever it is applied. Its vital principle is the treating of men as men. A. S.

Cleaning Cars with Oxalic Acid.

Although the practice of cleaning the outside of passenger cars has been followed ever since railroad trains began to run, there continues still to be great diversity in the methods employed to keep the paint clean. All sorts of cleaning material has been tried, but the objection to many of the compounds that would readily remove dirt is that they take off the varnish and paint as well. Of late years most of the roads have adhered to soap and water. The finest looking cars we have lately seen, that have stood the brunt of smoke and dust for months without being marred in appearance, are on the Chesapeake & Ohio. They are cleaned by a special kind of soap mixture prepared by an intelligent foreman. It removes the dirt, and yet leaves that glossy appearance of the varnish seldom seen except when a car is newly out of the shop.

On the Chicago, Burlington & Northern the master car painter under Mr W H. Lewis, superintendent of motive power, makes very successful use of oxalic acid for cleaning locomotive tenders and cars. This acid has been used for years by locomotive firemen for cleaning smoke stains and tarnish from cab fittings, but we are not aware of its being used for cleaning on a large scale except on the road mentioned. Mr. J. K. Lowry, foreman of the paint department, writing about cleaning with oxalic acid, says "I have used the acid for several years, and cannot see that it has any injurious effects by continued use any more than water alone, and for this and other reasons I consider it the cheapest and best preparation I know of for cleaning purposes. I cannot explain the cause of the chemical action that the acid has upon the smoke and dirt, but it seems to decompose the



CHIQUIHUITE BRIDGE, MEXICAN RAILWAY.

combined accumulation of dirt without having the well-known injurious effects consequent to the use of all leys or lime preparations, and to demonstrate the difference in the action of the acid and soap, try it on a freight car or any oil painted surface, and it will be seen that the soap acts immediately upon the paint, which can be seen by the coloring of the water, while the acid will clean equally as well without affecting the paint in the least.

In order to attain the best results from the use of the acid, it will require some

THE ALAMEDA, AVENUE OF PALMS, VERA CRUZ.

experience in its use. It can be used economically, and cost no more than soap, but if used profusely, as water usually is, it will necessarily be wasted. It is not necessary to use more of the acid water than enough to thoroughly wet the surface, rubbing it the same as with soap, and if very dirty, the use of a little ground pumice will facilitate the work. After it is cleaned, rinse off with water, and for nice work it should be rubbed dry with a chamois skin.

As to the quantity of the acid necessary to a given amount of water, will say about a pound to a gallon; however, the amount should be about all the water will dissolve. There is no danger of getting it too strong.

The members of the railroad mechanical conventions have remarkably good memories for injuries inflicted. When suggestions were in order to indicate the preference of members for the next place of meeting, nearly every available place in the country received mention except Cape May, which is really one of the pleasantest resorts in the country, except that its principal hotel is run by a man who made himself exceptionally obnoxious to his guests. There is a very decided desire that the next convention be held west of Chicago, and the members of the Master Mechanics' Association were strongly in favor of Manitou, Col. That is a delightful health resort at the foot of the Rocky Mountains, and we feel certain that it would be an enjoyable place to meet in.

One of the handsomest little catalogues that we have seen has just been issued by the Griffith, Axtell & Cady Co., of Holyoke Mass. It is a sample lot of fine embossed catalogue covers gotten up by this firm for advertisers and is entitled "A Mint of Hints." Any firm contemplating the issue of a good catalogue will find that one of these covers will add about 50 per cent. to the appearance of the work.

The Leslie Device for Kindling Locomotive Fires with Crude Oil, Instead of Wood.

The complete success of this device has been fully established in the kindling of thousands and thousands of fires on several of our important railways, on whose lines it has been adopted and put into general use. It has attracted wide-spread attention and created much enthusiasm on account of its cheapness, convenience, and the enormous saving which has been effected through its use.

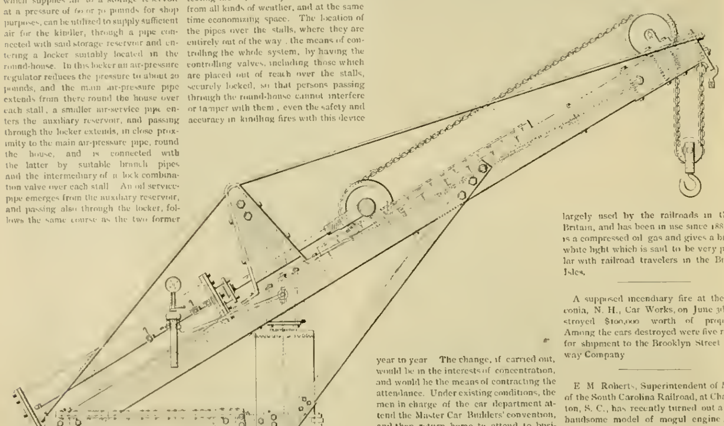
It consists of a suitable storage tank for the storing of the desired supply of oil for the different sized round-houses, a small tank or auxiliary reservoir is fed from the storage tank, suitable globe and check-valves being located between them—the former to shut the whole supply from the storage tank, if necessary, and the latter to automatically feed the required oil to the auxiliary reservoir. An ordinary air pump which supplies air to a storage reservoir at a pressure of 60 or 70 pounds for shop purposes, can be utilized to supply sufficient air for the kindler, through a pipe connected with said storage reservoir and entering a locker suitably located in the round-house. In this locker an air-pressure regulator reduces the pressure to about 20 pounds, and the main air-pressure pipe extends from there round the house over each stall, a smaller air-service pipe enters the auxiliary reservoir, and passing through the locker extends, in close proximity to the main air-pressure pipe, round the house, and is connected with the latter by suitable branch pipes and the intermediary of a lock combination valve over each stall. An oil service-pipe emerges from the auxiliary reservoir, and passing also through the locker, follows the same course as the two former pipes, a branch pipe being connected to same and also to the lock combination valve above the stalls, the latter so located as to be conveniently unlocked and opened from the engine. The whole supply of air and oil to these pipes is controlled by suitable valves placed in the locker before mentioned, in which also are located the gauges, all being placed under lock and key, in this way the absolute control of the whole system is in the charge of one person, and when the system is opened to service, the control of the supply to each stall is governed by its respective lock combination or regulating-valve. When a fire is to be kindled, sufficient coal is thrown into the firebox to cover the grate thoroughly, a light and easily handled burner, with two small holes attached for air and oil, is connected by suitable hose couplings to the lock combination valve, after the burner has been connected, by unlocking and opening the combination valve, the oil is brought into the house automatically and the air and oil simultaneously admitted to the burner. A small piece of greasy waste is then lighted and thrown into the firebox on top of the coal, the air and oil are then turned on to the burner by their respective valves, the necessary quantity of oil only being fed automatically, making it impossible to injure the firebox sheets, either through carelessness or otherwise.

When the fire has been kindled, by the closing of the lock combination valve the supply of air and oil is cut off simultaneously, and the oil remaining in the pipe is automatically returned to the auxiliary tank, after which the burner is disconnected.

The complete success of this kindler does not consist only in a device which will kindle locomotive fires with the least amount of *oil and air* possible to do the work efficiently, and with absolute safety from fire, but a series of years of actual experiment has enabled its promoters to produce a kindler in which every detail has been worked out in the simplest, cheapest, most efficient, and most economical manner possible.

The storage and auxiliary tanks are buried in the ground outside of the buildings and below the frost line, fully protecting the oil, not only from fire but also from all kinds of weather, and at the same time economizing space. The location of the pipes over the stalls, where they are entirely out of the way, the means of controlling the whole system, by having the controlling valves, including those which are placed out of reach over the stalls, securely locked, so that persons passing through the round-house cannot interfere or tamper with them, even the safety and accuracy in kindling fires with this device are not dependent upon the operator, but are due to the fact that those parts, which have to be manipulated by him, are so arranged that they are either automatically adjusted, or it is compulsory for him to adjust them properly to enable him to do the work, in this way protecting the property from all risks through carelessness or otherwise.

This apparatus is in use in over 200 stalls on the C., R. I. & P., and on the C. B. & N., Wisconsin Central and other roads. It is controlled by Mr. J. S. Leslie, of Paterson, N. J.



A Load-Weighing Pneumatic Crane.

The illustration shown herewith gives all the particulars that a mechanic wants of an ingenious crane made and used at the Dennison, Tex., shops of the M., K. & T., in charge of C. T. McElvaney, master mechanic.

They have a gauge on the cylinder that with a little computation shows the weight of any article lifted by the crane. This feature, it seems to us, is worth imitating on any hoist or crane around the shops of any road.

At the Dennison shops, they use six Westinghouse pumps, compounded, so that they get an air pressure of 120 pounds per square inch.

In his inaugural address to the Master Mechanics' Convention, at Saratoga, President Hickey expressed himself as favoring the consolidation of the Railway Master Mechanics' and of the Master Car Builders' Associations. We are aware that Mr. Hickey has advocated this consolidation for several years, but we believe that he is mistaken in calculating on the benefits which would result from the change. The work done by the two associations is so distinct, that very little time would be gained unless they narrowed the scope of the investigations now carried on from year to year. The change, if carried out, would be in the interests of concentration, and would be the means of contracting the attendance. Under existing conditions, the men in charge of the car department attend the Master Car Builders' convention, and then return home to attend to business while the master mechanics are away at their convention. Going to these conventions provides the only holiday which railroad mechanical men enjoy, and it is the only occasion on which many of them would be able to obtain transportation for themselves and families over foreign roads. This is not a high plane from which to argue in favor of letting the associations remain separate and independent, but the personal deprivations ought not to be overlooked in taking action towards a change.

In the shops of the Western New York & Pennsylvania, presided over by Mr. Allan Vail, general master mechanic, they have in use a simple form of air injector for drawing whitewash out of a bucket or barrel and squirting it upon the walls of shops that need a whitening application. This arrangement is more portable than that in which a closed drum is used to hold the whitening mixture. We understand that they are experimenting to find out how this system will work in the painting of freight cars and buildings. It is said that when a man uses the whitening jet for a short time, that he becomes so skillful in applying the mixture that very little is wasted. The time may come when all rough painting will be done by compressed air.

The Official Railway Equipment Guide has changed managers, and is now published at 132 Nassau street, New York, and Mr. John A. Chater is manager. The *Guide* has been enlarged and greatly improved and is now a most valuable work of reference for railroad men and others interested in rolling stock. Besides giving all particulars about the various kinds of cars and locomotives owned by all railroad companies and private lines, it contains exceptionally correct lists of the general and operating officers of all the railroads on this continent. In this respect it is superior to any of the lists published specially to give the names and addresses of railroad officers, for corrections are made every month, keeping the information up to date.

The Consolidated Car Heating Co., Albany, N. Y., announce that they have acquired the ownership of the Pope system of car lighting, and have decided to put it upon the market. This system is largely used by the railroads in Great Britain, and has been in use since 1886. It is a compressed oil gas and gives a bright white light which is said to be very popular with railroad travelers in the British Isles.

A supposed incendiary fire at the Laconia, N. H., Car Works, on June 3d, destroyed $100,000 worth of property. Among the cars destroyed were five ready for shipment to the Brooklyn Street Railway Company.

E. M. Roberts, Superintendent of M. P. of the South Carolina Railroad, at Charleston, S. C., has recently turned out a very handsome model of mogul engine; she weighs 105,000, of which 89,600 are on the drivers. The engine is reported as doing good work.

We have received a handsome photograph of the engrossed resolutions of respect given to Superintendent of M. P. W. T. Reed, on his resigning his position on the Chicago Great Western. The men also presented Mr. Reed with a purse of $350.

A circular has been issued by the authorities of Purdue University, intimating that the locomotive-testing plant, which was destroyed by fire a few months ago, has been rebuilt and is now ready for work. The locomotive "Schenectady," which was damaged in the fire, has been thoroughly repaired and is in place ready for work. Any railroad company having locomotives that they want tested can have the work done now without delay.

Manning, Maxwell & Moore, New York, report that they have received an order from the Frank Kneeland Machine Co., of Pittsburg, for one of their large three motor electric cranes, with an auxiliary hoist, being the second crane ordered by that firm. There are numerous inquiries for these cranes and this department of the Pond machine works is busy.

Pittsburgh Ten-Wheelers.

The annexed engravings illustrate a class of fine ten wheel locomotives built by the Pittsburgh Locomotive Works for the Terre Haute & Indianapolis, and reported to be performing remarkably good work. The engine is a fine representative of careful designing, every detail being worked out with close care and engineering skill. It will be noted that the engine has a straight boiler, which is a favorite form with the Pittsburgh people. We have frequently heard the objection raised against straight boilers that they do not carry water well if the same number of tubes are put in that can be used in a wagon-top boiler; but this boiler has 300 tubes in a 64-inch shell, and the engines are said to carry the water remarkably well. Throughout the boiler is a remarkably fine one, and well calculated to bear without distress the working pressure of 180 pounds. It is made of homogeneous steel, the shell being ⅝-inch thick. The horizontal seams are butt-jointed, with double welts, sextuple riveted; the circumferential seams are double riveted. The engine is equipped with the American brake, Westinghouse train signal, Monitor injectors, Nathan lubricators, Richardson balanced valves, solid rod cups, Laird guides, Ross brake shoes, and with every modern appliance necessary for convenience in operating and durability in service. All casings and the front end are made of pressed steel. The following are a few of the leading dimensions

Weight on drivers, 110,000 lbs.
Weight on truck wheels, 28,000 lbs.
Weight, total, 138,000 lbs.
Wheel base, total of engine, 23 ft. 8 in.
Wheel base, driving, 13 ft. 4 in.
Wheel base, total (engine and tender), 57 ft. 7½ in.
Length over all, total (engine and tender), 61 ft. 6½ in.
Height of stack above rails, 15 ft. 5⅜ in.
Heating surface, firebox, 158 sq. ft
Heating surface, tubes, 2,078 sq. ft.
Heating surface, total, 2,236 sq. ft.
Grate area, 32 sq. ft.

WHEELS AND JOURNALS.

Drivers, number, 6.
Drivers, diameter, 72 in
Journals, driving-axle, size, 8 × 10 in.
Journals, truck-axle, size, 5½ × 10 in.
Main crank-pin, journal, 5¾ × 6 in.

CYLINDERS.

Cylinders, diameter, 20 in.
Piston, stroke, 26 in.
Piston rod, diameter 3½ in.
Main rod, length, center to center, 9 ft. 6⅜ in.
Steam ports, length, 18 in.
Steam ports, width, 1⅜ in.
Exhaust ports, length, 18.
Exhaust ports, width, 3 in.

VALVES.

Valves, greatest travel, 5 in.
Valves, outside lap, ⅞ in.
Valves, inside clearance, 1/16 in.
Valves, lead in full gear, 1/16 in.

BOILER.

Type of boiler, reduced shell.
Boiler, working steam pressure, 180 lbs.
Boiler, material in barrel, homogeneous steel.
Boiler, thickness of material in barrel, ⅝ in.
Boiler, diameter of barrel, 64 and 70 in.
Seams, horizontal—butt joints, double welted, sextuple riveted.
Seams, circumferential—double riveted
Thickness of tube sheets, ½ in.
Thickness of crown sheet, ⅜ in.
Crown sheet stayed with radial stays, 1⅛ in. diam.
Dome, diameter, 30 in

TUBES.

Tubes, number, 300.
Tubes, outside diameter, 2 in.
Tubes, length over sheets, 13 ft. 2 in.

FIREBOX

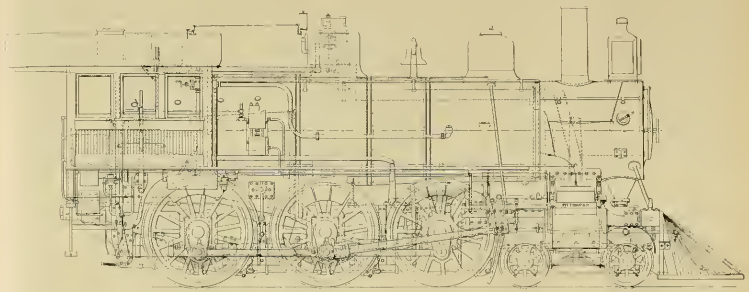
Firebox, length, 9 ft. 6 in.
Firebox, width, 3 ft. 4⅜ in.
Firebox, brick arch.
Firebox, water space, width, front 4 in., sides, 4 in.; back, 4 in.
Grate, cast iron, rocking.

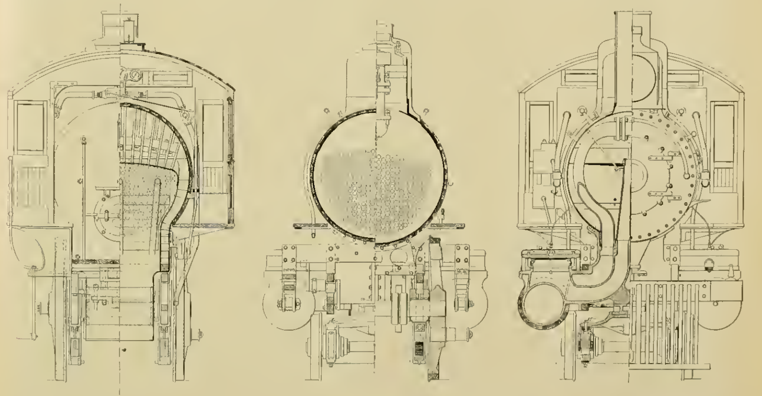
OTHER PARTS.

Exhaust nozzle, single.
Exhaust nozzle, diameter (four sizes), 4½ in., 5¼ in., 5 in., 5¼ in.
Stack, straight, with pressed steel base.
Stack, least diameter, 15⅝ in

TENDER.

Weight of tender, empty, 29,300 lbs.
Weight of tender, with fuel and water, 76,600 lbs.
Kind of tender frame, oak
Type of tender truck, diamond.
Wheels, chilled iron, 36 in.
Size of journals, 4 x 8 in.
Capacity of tank, 4,000 galls.





Night men in the Lake Shore yards at Elkhart missed lunch from their pails and one of them placed croton oil on a piece of pie. A fellow workman ate the pie and almost died.

The Merrill-Stevens Manufacturing Co. have erected a plant in Niles, Mich., for the manufacture of metallic cattle guards.

LOCOMOTIVE ENGINEERING
A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER AND ROLLING STOCK
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Award of the Prize Designs.

There were sixty-four designs offered for our cash prizes for the best design of the boiler fittings for eight-wheeled and consolidation locomotives.

The conditions to be aimed at were

1. Greater safety for the lives of the engine crew under any and all circumstances, especially in wrecks.

2. Convenience in handling the locomotive comfort of crew consistent with best road service.

3. Economy of time and money in keeping up running repairs.

On the whole the designs submitted were rather disappointing, there was nothing new of value offered, but the combination of good devices and the arrangement of them were admirable in many cases. We have no time to prepare the cuts of these designs for this issue of the paper, but will submit some or all of them in the next issue.

The awarding committee were as follows. Jos. McConnell, superintendent motive power, Union Pacific Ry., S. M. Vauclain, superintendent, Baldwin Locomotive Works, W. F. Dixon, chief draughtsman, Rogers Locomotive Works, Chas. Hogan, traveling engineer, New York Central Railroad, Samuel Hutchins, engineer, C. C. C. & St. L. Ry. All were present except Mr. Hogan.

Drawings, good, bad and indifferent were looked over patiently and sorted down to a dozen of each kind, these were discussed in every detail, and one by one dropped out for defects, until there only remained three of each kind. The committee did not especially recommend these designs, but decided they were the best advance on practical lines made, and most of the features were desirable.

THE WINNERS.

John S. Payne, of Wortendyke, N. J., won both first prizes; Fred. M. Westcott, of Toledo, O., won second prize on eight-wheeler, W. A. Eagles, of Newark, N. J., won third prize on eight-wheeler, Willis E. Holloway, of McKees' Rocks, Pa., won second prize on consolidation, G. A. Akerlind, of Rock Island, Ill., won third prize on consolidation.

The prizes are $100 for each first prize, $50 for the seconds and $25 for the thirds.

The Committee destroyed all other designs and descriptions and the envelopes containing names of competitors.

The winners have been sent their money as promised for the Fourth.

Personal mention will be made of the winners in the next issue.

Block Signaling.

Although America is entitled to the proud boast of having the finest net-work of railroads in the world, the splendid system of transportation is far from being so well equipped as ordinary prudence would dictate. Railroad extensions have been too often pushed into the wilderness to stretch out a long mileage that could be bonded and stocked at fictitious values. Where this policy was followed, the track and equipment were constructed with a regard merely to cheapness. Until within a few years the ordinary railroad was as bare of appliances for promoting the safe movement of trains as if nothing of the kind had been invented, and the train equipment itself was no better off. Year after year an army of human beings was killed through the want of means to stop trains promptly. Slowly the public conscience was aroused to the enormous and unnecessary sacrifice of life, and measures have now been taken to compel the general use of power brakes. This has been a grand victory in the interest of humanity.

The equipping of all trains with air-brakes will serve greatly to decrease the carnage of train operating, but the consummation of that victory merely cleared the field for action in another conflict. The battle of the brakes has been fought and won, although it lasted for many years; a battle for the general introduction of block signaling has now begun. It may be a stubborn fight, with the forces of do-nothing-that-costs-money on the one side, and the friends of humanity on the other, but there is no doubt as to the final outcome.

The railroads in this country as in all others, were first put in operation without any mechanical means being provided to keep the trains apart. The enterprising engineers in charge of the building and equipping of some of the earliest railroads conceived the necessity for some kind of visible signal to protect trains standing at stations, and several crude appliances were brought into use. The operating officers, however, preferred the use of rules in train movement that seemed to render fixed signals unnecessary, and within a few years after the opening of the Baltimore & Ohio, it became the recognized practice to place the responsibility for the safe movement of trains upon the train crew. This practice exists without change on most of our railroads to-day. As long as care, vigilance and intelligence can succeed in operating the trains without serious accidents, so long are the trainmen loaded with the heavy responsibility of doing the work without the aid of signals. It is only when a link in the human chain of vigilance fails and a disaster results that a willingness is manifested to adopt modern appliances. It is amazing, the persistent opposition which railroad managers, as a class, have displayed to the introduction of fixed signals. They could perceive in the system merely an addition to the operating expenses. They blinded themselves to the saving that would result through prevention of accidents. When crowded roads have been forced by the weight and vigor of public opinion to adopt block signals, the value of the system has frequently been neutralized by carelessness in the manner of operating the same.

The purpose for which displayed stationary signals were first recognized in this country to be really useful was in the protection of draw-bridges. A ball that could be raised to the top of a pole was the favorite means of indicating safety or danger. Many railroad men, however, considered that it was much safer for all trains to stop on approaching draw-bridges in the same way as they still do with level crossings. Next step in the slow progress towards signals was arranging for some means to show the time at which the previous train had passed. This practice gained wide application, and is still regarded by many railroad men as being of great utility. Much ingenuity has been expended in inventing signals which would remain at danger for a certain time after a train had passed. The fatal defect of the system is that a locomotive may fail or something may happen to the train requiring a stop to be made on rounding the first curve after a signal is passed. Unless the flagman is vigilant a collision is likely to happen, and the fact that the engineer of the next train has been led to believe that the way is clear, makes an accident all the more likely. Hundreds of accidents have happened under the circumstances described. The principle of establishing a time interval between trains has been tried in a great variety of ways without success. It is a form of reputed protection which does not protect, and the failures resulting have led a great many people to believe that signals are worthless for the prevention of accidents. This is merely true of a vicious system. The time system of signals may have been useful in its day, just as the straight air-brake was infinitely superior to the Armstrong, but it is a deception where trains running at high speed are numerous.

In England, where the cause of every railroad accident is thoroughly investigated by government experts, it was settled forty years ago that the only safe system of train operating was to put a certain space between each train. This was arranged by establishing a system of sections called blocks, each being protected by signals. No train is permitted to enter a block until the preceding train has passed off. This is called the absolute block system. In some form it is destined to be applied to all our railroads, for public opinion is getting rapidly educated to its advantages and the demand is growing for its introduction. Several of our leading railroads are operated under the absolute block system, and others have it modified to what is called the permissive block system. Under the latter, two or more trains may be upon the same block at one time, their entrance to a block not clear being regulated by a cautionary signal. This is often done to facilitate the movement of trains when signals are far apart. The permissive block system has most of the vicious features of a time signal system. With a certain class of men a system which divides the responsibility is an invitation to be careless. Many an engineer who might be depended on to avoid running into trains under the most trying circumstances when his own vigilance and judgment were his entire reliance, has failed utterly when the responsibility was divided between himself and a fallible signal system. From the records we have seen of operating under time signals and permissive block signals we are inclined to believe that it is safer to rely entirely upon the care of a well-trained staff of trainmen.

A variety of absolute block systems of signaling are now in use, and a variety of others with wonderfully developed mechanism are candidates for the patronage of railroad companies. The systems may be divided into three kinds—the manual, the auto-manual, and the automatic.

The manual is the oldest system of block signaling and depends entirely upon human care and judgment to be operated successfully. A man is stationed in the tower at the entrance to each block, provided with all the apparatus for operating the signal, and being in communication with the signalmen in the towers in front and behind. When a train enters the block the signalman turns the signal to danger and keeps it in that position until he receives notice from the tower ahead that the train has passed off the block. This system has worked remarkably well in Europe and on some of the railroads in this country, but it has the defect that the signalman may make a mistake and show a clear signal when the train is still on the block. It is a great improvement over the flagman, but it contains large loop-holes through which accidents have happened. A disastrous collision on the Long Island Railroad eighteen months ago, and another on the Pennsylvania Railroad in Jersey Meadows, testify to the necessity for improvement upon the plain manual block system. The tone of railroad managers in public discussions of the various block systems, indicates that the plain manual is falling into disrepute. While decidedly expensive to maintain and operate, it does not give absolute security in return.

A decided improvement upon the manual, is the auto-manual system, which contains ingenious mechanism that tends to prevent the signalman from making mistakes. If the signal mechanism is not tampered with, and is handled with ordinary care, the auto-manual system is practically perfect as a block system. When a train enters a block, and the signalman puts the signal to danger, the apparatus is automatically locked. It cannot be opened so that the signal may be set to safety until the lock is released by the signalman at the other end of the block. The stupid risks which men in charge of these signal towers will sometimes take is proved by the fact that means have often been taken to prevent the lock acting which prevents a signalman from clearing his signal before it is released. When it is found that practices of this kind prevail it tends to show that human agency ought to be eliminated from the operating of signals.

This desirable end is accomplished in the automatic systems. There are a variety of automatic block-signaling systems, the most valuable of which not only indicate that a block is not clear, but show danger if a rail is broken or any other serious defect of track exists. Most of the automatic systems are operated by electricity and have a track circuit, which consists in electricity connecting all the ends of adjacent rails in a block and insulating the rails that separate the blocks. The signal-operating mechanism forms a part of the circuit which embraces the whole of the track on a block, and the signals show safety when the block is clear. When a train enters upon the block the wheels break the current and the signal goes to danger. Some automatic signals are operated by compressed air, the actuating appliances being started by electricity. The only drawback to the electric automatic system is that the electrical appliances require a great deal of attention, and when they fail delays occur. But failure of the current leaves the signal at danger so that the worst which happens is delay of trains. The improvements in electrical mechanism are rapidly eliminating the failures of electric signals, and it may be expected that within a few years there will be no more failures from electricity than there is with water or compressed air.

An incident connected with the working of an automatic system may be given as a finish to this article. A company supplying an automatic signaling apparatus invited a party of railroad officials to witness the working of the system upon a road to which it had been applied. The party started out in a special train and they had not gone far when they reached a signal which obstinately refused to go clear although the party was well aware that no train was in the block. The experts went down and examined the signal, but they could see nothing wrong with it and they could not find why it refused to act. Much to the chagrin of the manufacturers, the signal had to be passed at danger and a bad impression was given of the system which the perfect working of following signals did not dissipate. The exhibition was acknowledged to be a failure and a black eye to the promoters. Next day when the railroad company's signalmen were investigating the cause of that signal failing to act, they discovered that a broken rail had cut the circuit.

To Make Owners Responsible for Defects of Cars.

Several years ago an addition was made to Rule 8 of the Master Car Builders' interchange rules, which made the owners of freight cars responsible for brake-shoes and journals renewed when a car was away from home. The working of this arrangement greatly increased the clerical labor in Master Car Builders' offices, and widespread opposition was excited. At every succeeding convention attempts were made to repeal the rule, and from the talk in advance it seemed certain that it would not remain in force more than one year. But when the time for voting came, it was always found that those who favored the holding of owners responsible for the renewal of brake-shoes and brasses were in the majority, and the rule was kept in force.

The old plan of each railroad company renewing the brake shoes and journal brasses, when necessary, to foreign cars passing over its road seemed quite equitable, for its cars would be treated in a similar manner when they were away from home. Why a change should be insisted on that added to the burdens of the M.C.B. offices and called for increased clerical help seemed a mystery, for there appeared to be no one reaping real benefit, and many railroad men had their measure of annoyance greatly increased by the disputes which arose concerning the rule. Events transpired at the last convention which directed considerable new light upon the rule. It appears that there are owners of certain lines of private cars who have habitually and systematically contrived to make railroad companies do the greater part of repairs to these line cars without any compensation. A bill might be sent to a private line under the old rule for cost of renewing brake shoes and brasses, but it was rarely done when it was not the general practice to charge the owners for these parts. The new rule, however, made the private car owners pay up, and a sentiment has been spreading, especially in the West, that it would be a good plan to hold the owners responsible for the renewal of several other parts now exempted when cars are repaired away from home.

Several superintendents of motive power from the West met on a train on their way to Saratoga, and they got talking about the impositions their roads had suffered under the inflictions of a few owners of private cars. Numerous instances were cited of railroad companies being compelled, by sharp practice on the part of the owners, to effect expensive repairs on private cars that were worn out in service. Various plans were suggested as remedies for this wrong, and it was finally decided to make additions to Rule 8, holding owners responsible practically for the whole parts of the car when renewals were made on foreign roads, and were not rendered necessary by accidents. It was felt that the principle of holding owners responsible for the renewal of broken parts would not only protect railroad companies from petty exactions, but it would do much to facilitate the movement of cars. A motion was made to add an article holding owners responsible for "drawbars or couplers, drawbar timbers, drawbar springs and sills cracked over transoms." To this was subsequently added center plates, and the parts relating to drawbars was changed so as to include only link and pin couplers.

The arguments used in support of that motion were that the change would tend to reduce the endless disputes and the intolerable delays now so common in car interchange. Inspectors at interchange points would have no inducement to delay cars unless the defects were of a dangerous character, and there would be less scheming to put the cost of repairs upon companies that had no right to pay for them. The move was so radical in character that the representatives of several large roads refused to support the change without consulting with their managers. On the motion being put to the meeting, it was lost by 386 ayes to 465 nays. It is confidently expected that the change will be made next year; and there is every reason that it will accrue to the benefit of every railroad company which is inclined to act fairly towards others whose cars they handle.

We received visits last month from a great many railroad men who came to New York after attending the mechanical conventions, and they were all delighted with the wonderful views of New York and its vicinity to be seen from our office windows. We had the pleasure of escorting some of them to look over the splendid ocean racers lying in the harbor, and were surprised to find the intense interest manifested in the machinery to be seen in these huge steamers. It never occurred to us before that examining steamboat machinery would give so much pleasure to railroad men. We intend in future to invite all our mechanical visitors to go and see the steamers. Don't fail to call when you are in New York. Our office is a Mount Pisgah.

At a meeting of the Central Association of Railway Officers held in Cincinnati, the article "Discipline Without Punishment," which appeared in the February number of LOCOMOTIVE ENGINEERING was read and discussed. The method of managing the men there described is exciting much attention all over the country, and several roads have already adopted it, while others are considering the advisability of doing so. Others are inclined to try Mr. Brown's plan with modifications to suit their own conditions. Mr. Darlington, superintendent of the Indianapolis division of the C. C. C. & St. L., had the article read at his staff meeting, and it aroused a lively discussion which resulted in a decision to try that plan of discipline.

A curious statement was made in a report submitted to the M. C. B. convention on safety chains for freight cars, to the effect that twelve roads, representing 226,351 cars favored the use of safety chains. It would be interesting to find out how many of the roads in question follow the practice of putting this useless appendage upon their freight cars. Safety chains were never of any practical value, and the growing introduction of automatic couplers leaves very little excuse for their being applied. Besides being useless they are a source of danger to the men coupling cars when switching is going on.

An iron manufacturer remarked, in this office the other day, that he would be willing to give $50 for the best explanation of the well-known fact that it takes more heat to melt charcoal iron than common iron. Perhaps some of our readers who know can make a claim for that fifty.

BOOK NOTICES.

THE ENCYCLOPEDIA OF FOUNDING, and Dictionary of Foundry Terms, used in the practice of molding. By Simpson Bolland. John Wiley & Sons, New York. Price, $3.

This is a dictionary and encyclopedia of everything and every term used in molding, and it seems to us would be almost as necessary to a progressive molder as the best tool in his kit.

The work contains some 535 pages, the subjects arranged in alphabetical form and gotten up in the plainest and simplest language. It is the only work of the kind extant, and will doubtless meet with a ready sale in its own field.

There are numerous rumors flying round about railroad equipment to be ordered in the near future, but the real contracts given out are frightfully few. Everybody suffering through the lack of orders is cussing Congress as the most tangible body to blame for the protracted depression.

PERSONAL.

Mr. F. E. Tubbs has been made master mechanic of the Jacksonville, Tampa & Key West, at Palatka, Fla.

Mr. R. G. Ward has resigned as roadmaster of the South Carolina road, and Mr. Littlefield, a New Englander, has taken his place.

Mr. George H. Hansel has been elected secretary and treasurer of the National Switch & Signal Co., with offices at the works, Easton, Pa.

Mr. A. M. Bickel has been appointed traveling engineer of the Michigan Southern division of the Lake Shore, in place of Mr. D. A. Fleming, transferred.

Mr. John Foulk has been appointed general foreman of rolling stock of the Jacksonville, Louisville & St. Louis, with headquarters at Jacksonville, Ill.

Mr. F. M. Stevens, late of the Baldwin Locomotive Works, has been appointed master mechanic of the Hoosac Tunnel & Wilmington Railroad, with headquarters at Readsboro, Vt.

Mr M. A. Kimmet, who has been connected with the Central of New Jersey for many years, has been appointed superintendent of the company's car works at Mauch Chunk, Pa

Mr. W. S. Jones, lately superintendent of the Central division of the N.Y. & N. E., has been appointed general superintendent of the South Carolina Railroad, in place of Mr. J. M. Turner, resigned.

Mr. R. G. Matthews, superintendent of the Buffalo and Rochester divisions of the Buffalo, Rochester & Pittsburgh, has been appointed general superintendent of that road, with headquarters at Buffalo, N. Y.

J. F. Sechler has been appointed master mechanic of the Elgin, Joliet & Eastern Railway, in charge of motive power and rolling stock, vice T. Downing, resigned Mr. Sechler's headquarters will be at Joliet.

Mr. J. H. Barrett, lately general superintendent of the Buffalo, Rochester & Pittsburgh, has been appointed general superintendent of the Cleveland, Akron & Columbus, and Ohio Southern roads, with headquarters at Cleveland, O.

Mr. Charles Hansel, C. E., at present Western manager of the N. S. & S. Co., of Easton, Pa., has been elected vice-president and general manager of that company, with offices at 32 Liberty street, New York, commencing June 1st.

Mr. E. S. Canman, the well-known railroad supply man, has accepted the position of manager of the railway department of Pottier & Stymus, New York. That firm is about to place a fine car seat upon the market, and the business will be in Mr. Canman's hands.

Mr. N Monsarrat, who has been appointed the receiver of the Valley Railway in the place of Mr J. K Bole, deceased, is well known in railroad circles from his long connection with the Cleveland Akron & Columbus, with which he has only recently severed his connection.

Mr. H. M. Sperry, who for some years has been connected with the Johnson Signal Company, as general representative, has tendered his resignation, to take effect June 10th. Mr. Sperry has been appointed as Western agent of the N. S. & S. Co., with office rooms 1236-7-8, The Monadnock, Chicago.

Mrs. H. G. Peters, Long Beach, Cal., wishes our assistance in finding the address of her brother, Richard Houston, who was running an engine out of Mason City, Ia., the last time he was heard from. If any of our readers know the whereabouts of the man, and will send it, they will do a kind favor to a dangerously sick woman.

A model of the McIntosh improved automatic oil cellar and sight-feed oil cup, which was exhibited at the Saratoga Convention, excited much favorable comment among railroad men. The device is so simple and inexpensive, and is such a thorough preventative of hot boxes, that it ought to be applied to every locomotive in the country.

Mr. E. T. D. Myers, president of the Richmond, Fredericksburg & Potomac, issued the following touching circular "It is with great distress that the death of W. H Trainham, for many years the master car builder of this company, is announced. He was a thorough workman and an exemplary man whose record is untarnished. His death is a great loss to us."

Messrs. R. J. Gross and H. Tandy, of the Brooks Locomotive Works, have gone to Brazil for the purpose of investigating matters connected with the operating of locomotives in that country. The journey has been considered necessary in connection with the order which the Brooks people received for sixty locomotives for the Central Railroad of Brazil.

Mr. C. A. Moore, the well-known member of the firm of Manning Maxwell & Moore, New York, has been favorably mentioned as a candidate for Governor of the State of New York. Mr. Moore is president of the Montauk Club of Brooklyn, and was in the chair at the dinner where Mr. Depew made the famous speech which directed the necessity for municipal reform in the city of Brooklyn.

In the election of Mr. W. H. Truesdale, receiver of the Minneapolis & St. Paul, to be third vice-president of the Chicago, Rock Island & Pacific, an able and popular railroad officer takes a step upwards. Mr. Truesdale has managed an unremunerative road with much skill, vigilance and care, and he will be a valuable acquisition to the Rock Island management. He is a most genial gentleman, highly popular alike with patrons and brakemen—the latter are the most penetrating critics of all railroad men.

Mr. J. D. McIlwain has resigned from the Harvey Steel Car Works, of Chicago, and accepted the position of superintendent of the Union Car Co., Depew, N. Y. Mr. McIlwain is one of the best known and ablest master car builders in the country, and we feel certain that he will prove a valuable acquisition to the Union Car Co He writes that he is now in charge of "the finest plant for building cars on earth." With such advantages we feel certain that Mr. McIlwain will beat all records in car building

When Mr David Clark, the well-known master mechanic of the Lehigh Valley, at Hazelton, Pa , walked up to pay his dues at the last Master Mechanics' Convention, the treasurer noticed that the $5 bill handed in had Mr. Clark's signature on the face. Inquiry brought out the fact that Mr. Clark is president of the bank. We believe that this is the only case in the United States where a master mechanic is a bank president There are several master mechanics who are mayors, and others enjoying honorable civic positions, but their distinction is faint beside a bank president.

Mr. J. H. McConnell, superintendent of motive power of the Union Pacific, made his mark as a speaker at the mechanical conventions as no new member has ever done before He makes no pretensions to oratory but talks in a modest style that means business His power as a speaker is in the facts which he strings off in rapid succession, his head being brimful of figures giving particulars of the points he is making. Mr. McConnell did not speak often but he never rose without having something to say that was worth listening to, and the members indicated by their attention that they appreciated what was said

In the new reorganization of the Richmond & Danville, East Tennessee Virginia & Georgia and Queen & Crescent systems, we are pleased to note that Mr W. H. Baldwin, Jr., general manager of the Flint & Père Marquette, is named as third vice-president, with charge of the operating department Mr Baldwin has achieved great success under discouraging difficulties, on a small road badly run down and with very limited resources. By careful intelligent management this road was put on a sound footing and the service machinery greatly improved at less expense than was formerly incurred in letting it run down. We shall be greatly disappointed if Mr Baldwin does not make a splendid record in his new position.

Mr F. F. Swain, of Chicago, a manufacturer of lubricants much used by railroad companies, was shot with murderous intent by Henry Vaughn last month. Vaughn had formerly been in Mr. Swain's employ, and was nursing some grievance which led to the violent act. Henry Vaughn was for about fifteen years on the Burlington, Cedar Rapids & Northern as fireman and engineer. He was highly popular with the men, and was for several years chief of the division of the Locomotive Engineers' Brotherhood, and was sent to several conventions as delegate. Lately he fell into drinking habits, and that got him into trouble. We know of no railroad workman who had a more promising career before him than Henry Vaughn had ten years ago And now!

One of the surprises of the Master Mechanics' Convention was the large vote given on the first ballot to Mr R. H. Soule for second vice-president. Mr Soule has not attended the Master Mechanics' Convention much, but he has taken a very active part in the Master Car Builders' Association, and was several times a favorite for president of that association He is one of the most accomplished mechanical engineers in railroad service, is an excellent presiding officer, and a pleasant, genial gentleman Most of our readers know that he is superintendent of machinery of the Norfolk & Western. It is not so well known that in the few years he has been on that road the rolling stock has been greatly improved and the train service made much more punctual, while the operating expenses have been reduced

Mr. J K. Bole, receiver of the Valley Railroad, and president of the American Steel Castings Co, died suddenly of apoplexy last month. Mr Bole was one of the most popular men in the country His business brought him into intimate contact with many railroad men, and he had thousands of warm friends among them. In fact, he possessed the happy faculty of making many friends and no enemies. We know of no man taken away of late years whose death came like a personal loss to so many friends. He was best known to railroad men through his long connection with the Otis Steel Works. Lately he has been working hard in connection with the American Steel Castings Co., and his admirable business management promised to put that company into a highly prosperous condition. As a business man, as a refined gentleman, and as a loving husband and father, J K. Bole had few equals We feel that one of our warmest friends has gone.

We are informed that the United States Head-light Co, Utica, N.Y, has purchased of M. M Buck & Co, The Dayton Manufacturing Co., Kelly Lamp Co, Steam Gauge & Lantern Co., L. A. Williams & Co, and The Adams & Westlake Co., the machinery, tools, patterns, etc., constituting their head-light business, together with thirty-two letters-patent and a number of applications for patents, covering all of the standard devices for illuminated numbers and signals in head-lights and other desirable improvements therein. It is the intention of the United States Head-light Company to unite with the patents and facilities thus acquired, the result of over forty years' experience in manufacturing headlights, for the purpose of embodying in them the latest improved devices which will add to the design, convenience and durability, furnishing head-lights for all purposes superior to any heretofore supplied, at the lowest possible price consistent with first-class material and workmanship.

Reports say that the Williams Palace Car Company, capitalized at $3,000,000, will begin the construction of cars in St. Joseph, Mo., to compete with the Pullman and Wagner companies. There is a saving of weight in the Williams car of 5,000 pounds. The berths will be a little longer than those in the Pullman and Wagner cars and about the same width. They will be arranged in about the same manner with upper and lower tiers. The rack upon which the mattresses will rest will be made of aluminum inclosed in a case of wood and will fold up in the same manner that an accordion does, and be deposited in the wall of the car in a space of one and seven-eighths of an inch thickness. Upon these frames will rest mattresses made of cloth and rubber, which will be inflated with air immediately before being put in use In the summer chilled air and in the winter warmed air will be used These mattresses, together with the bed clothing, will be stored underneath the seats when they are not in use

A motion was made at the Master Mechanics' Convention to put Mr. Charles Graham upon the list of honorary members, and it was carried by an enthusiastic vote, which indicated that many personal friends of this veteran master mechanic were present at the meeting Mr. Graham was one of the organizers of the Master Mechanics' Association, and always took a warm active interest in the meetings Twenty years ago he was considered one of the ablest mechanical men in America, and almost any railroad company would have been glad to secure his services. About that time he was offered the position of superintendent of one of the largest locomotive works, but Mr. Sloan, then general manager of the Delaware, Lackawanna & Western, would not let him go. Mr Graham is not a very old man, but he is incapacitated from active service by injuries which he received by being struck by a locomotive. His lower limbs are in defective working order, which prostrate his powers of locomotion. Otherwise he is well He spends a great part of his involuntary leisure reading engineering literature. He says that LOCOMOTIVE ENGINEERING does not come out often enough.

Adjutant-General Tarsney, of Colorado, who has come prominently into public notice through being forcibly taken out of a hotel in Colorado Springs and tarred and feathered, was once upon a time an engineer on the Denver & Rio Grande, and the J. P. of LOCOMOTIVE ENGINEERING did a little extra firing for him. Mr. Tarsney was trained as a lawyer, and his fertility of speech recommended him for success in that profession, but as a locomotive engineer he was nothing to boast about. He got discharged while Mr. G W. Cushing was general superintendent, and he went about telling that he intended to lick Mr Cushing. One day the latter gentlemen stopped off at Pueblo, and Tarsney went up and asked what he was discharged for, and before an answer could be given knocked off Mr. Cushing's hat, and then ran like a deer for the nearest shelter For the next few days he went around telling that he knocked the general superintendent down. Tom went off with the Populists and got to be a "general." In this connection it might be mentioned that the S. P. of LOCOMOTIVE ENGINEERING did his first journalistic work in this country for Governor Waite of Colorado, when the latter was proprietor of the Jamestown *Journal*. Some time afterwards the S. P was offered a permanent position on the editorial staff of that paper, but declined the honor.

A very graceful testimony of appreciation of the services of old members was made by the Master Car Builders' Convention in electing five of the oldest members to be life members. The men thus honored were Messrs John Kirby, F. D. Adams, C. A. Smith, George Hackett and Robert McKenna. Mr. Kirby may be said to be the father of the association. In 1864 there was a little meeting of master car builders held in his office, and plans were talked over for more intimate co-operation among railroad car builders in the handling of foreign cars. This resulted in the call for a meeting of master car builders at Springfield, Mass, when the National association was organized. Mr. Kirby took an active part in starting the association, and he was long its treasurer and for one year was president. Mr. Adams was one of the few present at the preliminary meeting, and he has always been an active and earnest worker. Mr. C. A Smith was secretary of the association for sixteen or seventeen years, and did more than any one man to keep it alive in times when apathy and senseless opposition were threatening its dissolution. Mr. Smith never misses a convention, although his voice is not loud on the floor he is an active worker. Messrs. Hackett and McKenna are old members still in active railroad service, and ever ready to give assistance to committees or in any way work to promote the interests of the association.

A notable thing about the Master Mechanics' Convention, held at Saratoga, N. Y, last month, was the number of new faces to be seen in the meetings. There were fifty or sixty men who had never been at one of the conventions before. But there were several of the old veterans present who are known to very few master mechanics' now in active service. First among these might be mentioned Mr. G. A. Coolidge, from Charlestown, Mass., an honorary member who was long master mechanic of the Fitchburg Railroad. He is a venerable-looking old gentleman, and displayed warm interest in the proceedings but had nothing to say in the meeting. Railroading of to-day has drawn away from the practices of his time and new problems have come up as living issues that were never heard of in his day. Twenty years ago one of the best known master mechanics in New England was Mr John Thompson, of the Eastern Railroad. He was the inventor of the extension smokebox and first made that form of spark-arrester a success. Mr Thompson attended the convention, and his genial face attracted new friends and acquaintances, but few of the new men who grasped his hand had any idea of the prominent feature he had put upon the locomotive. At a convention in the early seventies a most interesting and amusing paper on Balanced Valves was read by Jerome Wheelock, an associate member, who was an engine builder in Worcester Mass Mr Wheelock was present at the Saratoga meeting, and most of the members took him for an Episcopal clergyman of engineering tastes. He is full of years and of engineering reminiscences, but has changed his views on the subject of balanced valves.

"It is curious the events that sometimes exert powerful influence upon a person's life," remarked Mr John Player, superintendent of motive power of the Atchison, Topeka & Santa Fé, as a few friends were exchanging reminiscences on the piazza of Congress Hall, Saratoga, during the convention time. "Do you know," he continued, "that I got my first real start by having a fight with another boy? It happened this way. When I was about thirteen years old, I went to work in the Woolwich Arsenal, doing odd jobs in the office and for the foreman. The best position for a boy was to enter the machine shop as an apprentice, but that privilege was greatly sought after, and my parents had not enough influence to get me entered as an apprentice. One day I was going round the shop delivering checks to the men, and another boy hit me in the face with a lump of wet greasy waste. I did not for a moment reflect upon the august rules of the great Government establishment, but jumped upon the boy and began to thrash him. I knocked him down upon a revolving grindstone which was set level with the floor and it carried him round and sent him sprawling along the shop. Just at that moment the superintendent happened upon the scene, and promptly kicked me out of the place. A week or two after, I met the assistant superintendent on the street, and he asked me why I was not at work. I told him the story and he told me to go to work in the machine shop next day, but to be careful to keep out of sight when the superintendent came round. So I went to work as an apprentice, but had to dodge out of sight for a year or two every time the superintendent came round. I believe, however, that he knew all the time that I was there, but the rules of the place had to be upheld. He was one of my best friends after I grew up."

EQUIPMENT NOTES.

The Lehigh Valley have ordered three locomotives from Schenectady, and they are reported to be in the market for 2,000 coal cars.

Baldwin's people have received orders from the Missouri, Kansas & Texas for five consolidation locomotives, and from the Cincinnati, Lebanon & Northern for some eight-wheelers.

The Star Head-light Co., of Rochester, N. Y., of which Mr. S. H. Wheelhouse is railroad representative, has closed a contract with the People's Traction Co., of Philadelphia, for 300 head-lights.

The firm of Ridsdale & Lewis, 39 Cortlandt street, New York, have put on the market the Duval metallic packing for locomotives. This packing is made entirely of metal woven in any desired shape, and is handled as easily as fibrous packing, while giving the same effects as sectional metallic packing. A 380-H P Buckeye engine had the pistons packed with this packing four years ago, and it has not been touched since.

The Pyrotechnic Railway Signal Co, New York, have a device which is calculated to be a good protection for trains on roads not protected by block signals. It consists of a small iron carriage, weighing about five pounds, which can be adjusted on one rail, and it is propelled along by a rocket attached to the carriage. When the rocket is lighted, the thing shoots along at a high rate of speed burning a bright red light. An exhibition of the invention was given at Saratoga during the convention, and it worked to perfection

New repair shops for the Buffalo & Susquehanna road are to be erected at Galeton, Pa. The shops are expected to employ 150 men, and to have a capacity of 50 locomotives and 1,000 cars a year when running full force. Some of the contracts have already been let, and the work of building is to be begun in thirty days and is to be finished in six months The dimensions of the buildings are Paint shop, 50 x 150, roundhouse, 70 x 180, containing seventeen stalls, of which six will be at once built, machine shops, 100 x 150 feet, car shops, 75 x 135 feet, planing mill, 50 x 80 feet office, 40 x 70 feet.

The Elements of Boiler-Making—IV.

SHEET-IRON WORK.

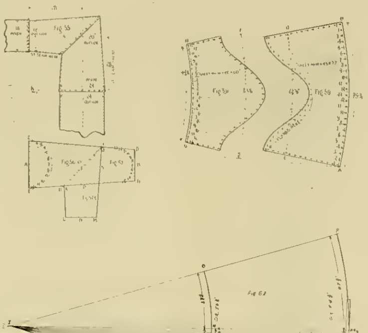
By C. E. Fourness.*

A man wishes a square elbow built of No. 10 steel to connect two pipes, one 24 inches in diameter outside, the other 16 inches in diameter inside, this necessitates the elbow being tapered as shown in the side elevation, Fig 55.

In laying this out, first in order comes the outline view, Figs. 56, 57, and 57A. First draw the center line A B C, then I A F at right angles to A B C, 24 inches long and 12 inches each side of A. By referring to Fig. 55, the distance from the center of one pipe to the center of the rivet holes in the other is 28 inches, consequently locate O 28 inches from A and B and N 28 inches from O, N being on the line O P N, at right angles to A B C. At B draw D B G at right angles to A B C, 16 inches long and 8 inches each side of B. Draw L N M at right angles to N P O, 16 inches long and 8 inches each side of N. Draw the lines E D C, and F G C from O as a center with the distance O P (the radius at that point). Mark the points R and S, set the straight edge to the points M and S, and draw the line I S M. Set the straight edge again to the points R and L and draw the line H L; then from the points I and H, where the line I M cuts E D, and where H L cuts F G, draw the diagonal line I H, and draw J K one-half (½) inch from and parallel to I H, this latter line is for the rivet holes. From A, as a center with the distance A E for a radius, draw a semi-circle, E A F will be the diameter. Space off this semicircle for thirteen points or holes and number them 1, 2, 3, 4, etc., beginning with No. 1 at E, and ending with 13 at F. Set the straight edge at each of the points successively to draw the ordinates through these points of division on the circumference of the semi-circle at the large end, and at C the vertex of the angle, for the other end the ordinates are to be drawn between the lines or diameters D B G and E A F.

Next in order comes the sheets. First, take the sheet to form the course (Fig. 56), set the trams to the length from C to F (Fig 56), and draw the line or arc A B, (Fig. 59). A and B to be located five (5) inches from the side of the sheet. This line forms the camber for the holes on that, the large end. Preserve the center K, from which this arc was drawn, then set the trams again from C to P (Fig. 56) and draw another arc. C D (Fig. 59), using the point K as a center. These are the lines A B and C D to lay off the circumference upon. The end E A F (Fig. 56) is 24 inches in diameter inside, and to find the circumference, I will use a somewhat different method, by adding once the thickness of the material, ⅛ of an inch, to the diameter for a new diameter, which equals 24 125, this multiplied by 3⅐ equals 75¾ inches, this length lay off on the line A B (Fig. 59), and from the point midway between A and B draw a line for a center line pointing to the center K, cutting the line C D. To find the diameter at this point, I add the diameters of the ends together, and divide the seven by two for the average diameter or the diameter midway between the two ends which equals 20 inches. By referring to Fig. 55 I find the course must be 20 inches outside, 20×3⅐=62⅞ inches, and three times thickness, or ⅜ of an inch less, equals 62½ inches. This length lay off on the line C D, an equal distance each side of the center line drawn. Space off the lines A B and C D, each into twenty-four points, this will be the center of the rivet holes on the line A B. Draw lines through each of the correspondingly numbered points on the lines A B and C D, and number them 1, 2, 3, 4, etc., beginning with No. 1 at the ends or straight seams, and ending with No. 13 at the center. Transfer the lengths of the ordinates between the lines E A F and H I (Fig. 56) to the correspondingly numbered lines in Fig 59, measuring from the center of the holes on the line A B. Center these points just found, as after the sheet is rolled it must be flanged here to fit into the other course Allow 1 inch outside of these marks for the flange, space off the straight seams for thirteen holes, leaving the last at least ¾ of an inch from the center marks for flanging, allow one-half (½) inch outside of the holes for the lap, and the course is complete

*Foreman Boiler-maker, C M & St. P Ry Dubuque, Iowa



Now for the other course, Fig. 57A The straight seam comes on the line or side, L H, suppose this part, bounded by M N L H I S, was given a one-half (½) revolution on the plane H I, it would then be in the same position that Fig. 57 occupies. By doing this, one set of ordinates answer for Figs. 56 and 57, but number them differently by starting with No. 1 at G and ending with No. 13 at D. Set the trams to the distance C G (Fig. 57) and draw the line G H (Fig. 58), the points G and H to be one-half (½) inch from the side of the sheet. Set the trams again from C to P (Fig. 57), and draw the line E F (Fig. 58) from the same center used to draw G H Referring to Fig. 55, the diameter is 20 inches inside at the point O P (Fig. 57), and the circumference of a diameter of 20 inches as found is 62⅞ inches. As it is to be this diameter, 20 inches inside, add three times the thickness, or ⅜ of an inch, this equals 63¼ inches, which length or circumference lay off on the line E F. Set one end of the straight edge to the center from which the arcs were drawn, the other at a point midway between E and F, and draw a line for a center line a little distance across each arc E F and G H Referring again to Fig. 55, the diameter at the small end is 16 inches outside, 16×3⅐=50¼ inches, less three times the thickness or ⅜ inch equals 49⅞ inches. Lay off this length on the line G H, one-half on each side of the center line. Space off the lines G H and E F into twenty-four spaces, and number the points found from 1 to 13, beginning with No 1 at the center and ending with No. 13 at the ends or straight seams. Draw lines through the correspondingly numbered points or marks on both lines, and transfer the lengths of the ordinates between the lines D B G and J K (Fig. 57) to the similarly numbered lines in Fig. 58, measuring from where the lines last drawn cut the arc G H. These marks just found will be the center of the rivet holes in the diagonal seam, and the holes can be punched, as this course will require no flanging. Space off the line G H for twenty holes, as the twenty-four holes would bring them too close together Then space off the straight seams for five holes, and after allowing one-half (½) inch outside of the rivet holes for lap, the sheet is ready to shear and punch.

In our next I will endeavor to give in a plain manner, the methods of finding the camber or curve that sheets must be cut to in order to form the envelope of cones or frustums of cones There are several approximate methods for finding this curve or camber where the difference in the two diameters is but very little, but for my part I believe in the old reliable, and in making use of this method (radial line and a square), there are no exact number of lines to be used, but generally it (the circumference) is spaced into as many points as there are holes, as this saves spacing again, but in case of a rush job use a less number of lines say four lines each side of the center, but the greater the number of lines used (the closer together) the more accurate the result. I, for quite some time, supposed that the method of using lines and a square was only approximate as I did not understand the principle of it, but in Figs 61 and 62 both methods are shown, one-half the sheet is laid out with the trams, the other half with a square, and as you can see for yourself, the results are the same.

I want to lay out an envelope or sheet to form a frustum of a cone, 30 inches in diameter at the bottom, 18 inches in diameter at the top and 67 inches high, as shown in Fig 60, and will proceed to lay it out by first drawing the center line A B C, next E A F, 30 inches long, 15 inches each side of A, and at right angles to A B C, 67 inches from A. At B draw D B G, 18 inches long and 9 inches each side of B, then draw the sides E D C and F G C. This completes the figure.

Draw the center line H N I, Fig. 61. I will lay out this one-half (½) with the trams first, as Fig. 60 is already drawn and is needed in using this method. Set the trams to the distance, C to E, Fig. 60 Next set one end at H, the other at I, Fig. 61, and draw the arc H P, set the trams again from C to D, Fig. 60, and carry to Fig. 61. Set one point at I, and with the other draw the arc N O. The circumference of 30 inches is 30×3⅐ = 94¼, and one-half is 47⅛ inches, which length I lay off from H to P The circumference of the top end is 18×3⅐=56½ inches, one-half (½) of which is 28¼ inches. This length I lay off on the arc N O, set the straight edge at P and I, and a line drawn from P will just cut through the point O, consequently it is only necessary to find the circumference at one end, as a line drawn to the center will give the other. This, as you will notice, is a very convenient method of accomplishing this result, but when you have a taper course or frustum of a cone where the difference in the diameter at the top and bottom is very little, just the thickness of the iron, perhaps, then it will require trams of extraordinary length, and another system or method must be adopted. There is another method, Fig. 62, by using radial lines and a square, which I will proceed to explain. Draw the line H J, Fig. 62, at right angles to H N I, and one-half the circumference of the large end, 47⅛ inches long, draw N L 67 inches from and parallel to H J. Make N L one-half the circumference of the small end, or 28¼ inches in length, space H J into 17 points, and number them from 1 to 17, calling H No. 1 and J No. 17. Space N L into 17 points, numbering them from 1 to 17, calling N No 1 and L No. 17. Draw lines through points correspondingly numbered, as 2.2, 3.3, 4.4, etc. In this case they are drawn to the center I merely to show how nicely the lines draw to the same center from which the arcs in the other one-half were drawn. Take a square and lay it along and to the line 2.2, the blade just up to the point H on the center line, or line 1.1, make a short mark across the line 2 2'. Move the square to the line 3.3 with the blade at the short mark across the line 2.2, make a short mark across 3.3, move the square again to the line 4.4, the blade to the short mark across the line 3.3, and make another mark across 4.4. Proceed in the same manner until number 17 has been treated, and if the work has been performed accurately the arc H K will be similar to H P. Set the trams to the length H N, or 67 inches, and place one point at the intersection of the small mark with the line 2 2 at 2, and make a small mark across the same line at 2. Set one point of the trams at the intersection of the short mark with the line 3.3 at 3, and make a mark across the same line at 3. Proceed in a similar manner to 17 17, and the arc M N will be exactly the same as N O. Measure off on the arc H K 47⅛ inches, one-half the circumference at the large end, notice this overruns the line 17.17. Next measure off on the arc N M 28¼ inches, one-half the circumference at that end, this also overruns. Draw a line from K to M, this will be the edge of the sheet or envelope, and if the line K M were continued it would cut the center I

Before taking up a new subject, perhaps

it would not be amiss to take up a little matter pertaining to smokestacks. A man came to me, he had bought two second-hand boilers, he wanted a smokestack. But first he wanted to know if these boilers had the proper sized openings in the smokebox or breeching. He said one boiler, 48 inches in diameter, had fifty-eight flues 3 inches in diameter, and the opening for the smokestack was 22½ inches in diameter. The inside area of a 3-inch flue is 6 square inches, and this times fifty-eight (the number of flues) equals the total area of the flues, 6 × 58 = 348 square inches. The area of a circle 22½ inches in diameter is 397.6 square inches. From this subtract the area of the flues, 348 square inches, this gives a difference of 49.6 square inches; divide 348 by 49.6, the answer will be 7, and shows that the opening in the breeching is ⅐ greater than in the flues, and is about the right proportion, as the openings are made from ⅛ to ¼ larger than the flue area.

The other boiler was 60 inches in diameter and had 54 flues 4 inches in diameter, and had an opening of 31 inches in diameter in the smokebox for the stack. The area of one flue is 11 square inches and 11 × 54 = 594 square inches total flue area. The area of a circle 31 inches in diameter = 754.76 square inches, the difference between 754.76 − 594 = 160.76, and 594 ÷ 160.76 = 3.69, showing that the area in the opening to the stack is about ¼ greater than the area of the flues and is all right (this latter opening is slightly greater than ¼, but I call it ¼, as it is quite close to that figure).

The man next said he wanted a smokestack, one stack for the two boilers. But [illegible] he wanted the proper size of the [illegible] or conduits to connect [illegible] boiler [illegible]. For the [illegible] boiler the opening [illegible] ⅐ greater than the area of the flues, consequently there should be ⅐ more added to it, as there should be ¼ more [illegible] the stack than in the flues. The [illegible] was 397.6 + 49.6 = 447.2, and the [illegible] a circle to contain that area [illegible] to be 23[illegible] inches, call it [illegible].

[illegible] stack or circle that contains [illegible] of the 24 and 31-inch branches.

[illegible] four (4) different methods of [illegible] this result. First find the [illegible] each and add together, then find [illegible] diameter of a circle that contains this [illegible].

$24 \times 24 \times .7854 = 452.38$, and $31 \times 31 \times .7854 = 754.76$.

$452.38 + 754.76 = 1,207.14$ square inches total area, and to find the diameter of a circle that contains this area it will be necessary to reverse the operation.

$\sqrt[2]{1,207.14 \div .7854} = 39.20$ or $39\frac{1}{4}$ inches; call it 39 inches in diameter.

The second method, if you will notice in the first example, I multiply first by the decimal .7854 to find the area, then divided again with the same decimal to find the new larger diameter; this overcomes the effect of the multiplication, and in this second method I will get the same result by just merely squaring the diameters.

$24 \times 24 = 576$ and $31 \times 31 = 961$.

$576 + 961 = \sqrt[2]{1,537} = 39.20$.

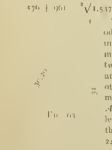


Fig. 63.

The third method is to find this in a practical manner. Draw two lines at right angles to each other (Fig. 63), make the base A B equal in length to one of the diameters as 24 inches, and the perpendicular, AC equal in length to the other diameter, or 31 inches long; then the hypothenuse or length from B to C will be the diameter of a circle equal in area to the two smaller circles.

The fourth method is to figure or find the length of the hypothenuse. By figuring the square of the base plus the square of the altitude equals the square of the hypothenuse, and the square root of this equals the diameter required.

$24 \times 24 = 576$ and $31 \times 31 = 961$.

$576 + 961 = \sqrt[2]{1,537} = 39.20$.

Find the size smokestack required for a boiler having 24 flues 3 inches in diameter.

Rule—Square the diameter of the flue and multiply by the number of flues, and the square root of the result is the diameter required.

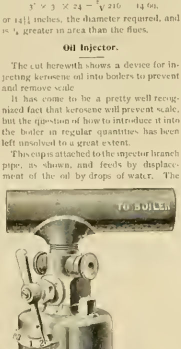
$3'' \times 3 \times 24 = \sqrt[2]{216} = 14.69$, or $14\frac{11}{16}$ inches, the diameter required, and is ¼ greater in area than the flues.

Oil Injector.

The cut herewith shows a device for injecting kerosene oil into boilers to prevent and remove scale.

It has come to be a pretty well recognized fact that kerosene will prevent scale, but the question of how to introduce it into the boiler in regular quantities has been left unsolved to a great extent.

This cup is attached to the injector branch pipe, as shown, and feeds by displacement of the oil by drops of water. The



feed is regulated by the lever shown, and the drops can be seen through the glasses on each side.

As there are 2,400 drops of oil in one pint, it is an easy matter for the engineer to set his feed to supply a given amount of oil per hour.

Some thirty of these cups are in existence and doing regular work satisfactorily. They are neat, placed out of the way and require little attention. They are made and sold by the Climax Injector Co., of Springfield, Ohio.

Science of Railroading.

BY J. E. PHELAN.

The following are a few extracts from an excellent lecture recently delivered by Mr. J. E. Phelan, master mechanic of the Northern Pacific at Fargo. We regret not having room to publish the whole address.

"The intelligent consideration of any subject must be broad enough to encompass the known field of nature, and the natural development of railroads, if successful, must continue along lines of environment as indicated by the wants and desires or necessities of cosmopolitan population. This is a study as interesting as 'Darwin's Origin of Species,' or 'Descent of Man,' and fraught with vital consequences in the struggle for existence, for the magnificent and powerful devices created by man as existing in railroad property, strengthens mankind in proportion to its well-directed and consummate motion and activity. In further consideration of the cause and governing influence in the railroad's existence and prosperity, we can view the activity in railroad building in the United States, dating in its origin as late as 1827, and at present approximating 175,000 miles.

"Great Britain in about the same time has acquired about 20,000 miles, while France equals Great Britain, and the German Empire exceeds Great Britain about 5,000 miles.

"The Russian Empire in Europe has about 20,000 miles of railroad, with about 30 per cent. more population, it has about 80 per cent. less railroads than the United States.

"For the past five years railroad building in the United States has averaged about 5,000 miles per year, or 1,000 miles per year more than for the seven years preceding the panic of 1873, but this will not seem so remarkable when we find for five years prior to 1852, 40,000 miles of railroad was constructed in the United States, or 8,000 miles per year. For the five years following the panic of 1873 this country constructed 2,800 miles per year. We have seen considerable complaint in the newspapers for several years back about the depressing influence of Canadian railway lines, especially on transcontinental traffic, but not very much about the depressing influence of home competition, struggling for revenue from sources of supply expanded and stimulated to a suicidal extent. While this remarkable railway building within the United States progressed and stimulated the cultivation of immense areas of new land and the development of mines and mining, all tending to an enormous output of natural products, the most important field in contemporaneous history to view, in my mind, embraces other new countries. The development of railroads and new country in Canada, while important, is but a small factor when viewing other new fields. Canada, with an area of about 3½ million miles, has less than 15,000 miles of railroad, while the Argentine Republic with only about one-third the area and about three-quarters of a million less inhabitants has over 6,000 miles of railroad. Chili and Peru have developed railways to a remarkable extent, considering population. Brazil and Mexico have been fairly active, and each have over 5,000 miles, while Cape Colony, Victoria, New South Wales, Queensland, South Australia and New Zealand, considering the location and conditions, have shown activity in railroad building corresponding in degree with other new countries. Railroad building in India has been active in recent years, and now has railroad mileage exceeding that of Russia or the United Kingdom. Compare the products of all new countries or of territory where railroad building has been most active, and you will find such products corresponding to those produced in the United States to a remarkable degree. Can you wonder at the low price of wheat and other products of new countries and corresponding depression in railroad securities in the light of such circumstances?

"Is not overproduction most natural under such a stimulant, and can that portion of the population who dig their revenue out of the ground, continue to purchase manufactured articles where profitable revenue is not realized from their labor?

"While the products of new countries are forced on consuming markets, every effort is made by the older countries to favor home industry, and shut out the constantly cheapening products from the newer countries. We are now at a stage where the big fish must eat the little ones and the stronger destroy the weaker organizations. You may recall the words of Lord Bacon over the entrance to the Transportation Building, at Chicago: 'There are three things which make a nation great and prosperous—a fertile soil, busy workshops and easy conveyance for men and goods from place to place.' We can but respect the part that the 175,000 miles of railroad in the United States must play in sustaining the activity and greatness of the nation, and I do not err in saying that the railroads of the United States must be powerful or popular enough to invoke the aid of government for the common good, or ultimately become an adjunct or ward of the general government of the nation.

"In this respect it must be understood the government is by and for the people. Herein we must recognize the great advantage of a general education, both technical and practical for the enlightenment of government and railroad employees for the common good. So long as railroad employees are in advance of government employees in point of technical or practical training, or *vice versa*, so long interference one with the other will seem meddlesome and abortive. So rapid has been the development of railroad mileage, that general education in the details of railroading has marched on the flank of railroad progress rather than in the van, for location and operation; in fact, the whole field has presented an animated aspect of Kindergarten principles as applied both to investors and operators. Construction of railroads in the United States not only advanced into new territory inland, but has also paralleled canals and watercourses in successful competition with navigation; it is a natural conclusion that railroad lines built with grades corresponding to the surface levels of navigable waters, affording the least resistance and requiring a minimum force or energy to propel the loads, can be depended on to exist and gain compensation in competition with the cheapest method known for conducting transportation.

"The railroads built under the stimulating advantages pertaining to a new country, with steep grades and sharp curves must modify the resistance in every possible direction within limits to insure compensation for traffic, under a tariff fair to producers and successfully maintained on merit against the efforts of competitors. Able men in railroad management have provided, within recent years, powerful locomotives to successfully overcome the resistance of steep grades, and at the same time propel tonnage sufficient to insure profitable returns, while at the same time the weight and capacity of cars have been increased in the same ratio. In turn, roadbed and bridges have necessarily increased in strength and cost to sustain increasing weights of rolling stock. Thus, the tendency had been to overcome resistance by main force, and while eminently successful at an apparent reduction of cost in operation, yet the obstacles in form of steep grades, sharp curves, and unnecessary distance in many cases, remain to worry and absorb energy and revenue without compensating returns.

"While development has been successfully carried on, other able men in management have successfully carried out the principles of removing resistance by revision and reduction of grades, curves and unnecessary distance. By such methods you not only do away with excessive resistance, but, in proportion to the degree of resistance removed, you increase the efficiency of motive power. The most progressive civil engineers have demonstrated this principle to a satisfactory conclusion. I cannot follow this branch of science in railroading to a point of general analysis, but will simplify ideas by saying that the engineers who view this matter of location for the most economical results in operation, favor the location of railroads, when practicable, on a grade as water may flow evenly and when coming to a point of rapids or necessary to climb a divide or go over a mountain grade, accomplish the ascent in the shortest distance, as you would continue a canal by the introduction of locks, introducing at the railroad locks, or short distance grades, helper engines. This principle insures maximum tonnage being hauled for the greatest distance until necessary to overcome unavoidable resistance. It can be done in the shortest space of time at minimum cost."

Practical Letters from Practical Men.

Facts Wanted. There's a glut of Opinions.

Write on one side of the paper, state your point plainly and briefly, and then quit. We supply the generalities. No letters noticed unless name and address are annexed.

Leaks in Train-Pipe Showing on Gauge.

Editors:

Mr Orange Pound, in an article in the June issue of your paper, questions the correctness of a statement of mine, which appeared in the April issue, to the effect that, with the handle of the engineer's valve on "lap" a leak in the train-pipe will show on the gauge by a falling of the black pointer. He says, "This is all right with the 1880 valve, but not so with the 1890 or 1892 valves, they have gauge connected to equalizing discharge reservoir."

He evidently lost sight of the fact that the packing ring in the equalizing valve-piston is never a tight fit, and that on account of the small capacity of the equalizing reservoir leakage past this ring will be sufficiently rapid to indicate on the gauge any ordinary reduction in train-pipe pressure in spite of the fact that the equalizing port is closed. To substantiate my assertions I have just made some tests on one of the latest Westinghouse valves, and find that with the handle on "lap" and a fair sized leak in the train-pipe on a train consisting of an engine and one car, the black pointer on the gauge will fall from 70 to 60 pounds in a little over 20 seconds, and if all the air be exhausted from the train-pipe suddenly the black pointer will fall from 70 to 60 pounds in about 8 seconds.

Other valves can undoubtedly be found in which the packing rings fit better than the one tested above, but no ring was ever made to fit so closely that, under the conditions mentioned, it would not permit sufficient leakage to indicate every appreciable reduction in train-pipe pressure on the gauge.

PAUL SYNNESTVEDT.

Chicago, Ill.

A Pound Hard to Locate.

Editors:

Maybe the readers of LOCOMOTIVE ENGINEERING will be interested in a curious trouble we had with one of our 18 x 24 McQueen passenger engines that puzzled several of the smart ones. She went in the back shop to have a little flat spot turned out of her tire and a few flues pulled; very little other work was done on her. When she came out again she rode so hard that it was an awful task to run her, she just jumped right up and down when running fast and pounded horribly on her left side. Ike, our traveling engineer, said she had too much lead on the left side, but the man who set her valves when she came out said they were exactly square; the eccentrics which were keyed on the shaft were not moved. She had two heavy exhausts on the left side, two light ones on the right side, but they were just a quarter of a turn apart, so then Ike said she had more port opening on left side than right. Two different men run her valves over by the punch marks on the valve-stem. They said she was square as a die. All this time she had a pound on left side when working steam in short cut-off. They trimmed her, she was square in her boxes and centers, the pins were quartered right and not sprung any, side rods right length. They tried her everywhere outside her steam chest without getting on to the trouble, but when they took up the steam chest cover it showed up mighty quick. She had an Allen valve, and one of the corners on front side had a piece broken off about 3 inches long back into the Allen port which goes up over the back of the valve, so there was live steam in this port all the time. That gave her ¾-inch lead on that side more than right side. Of course the port closed that much later, too, so she was working steam on left side against the piston, which made her thump bad, and took steam for a longer part of the stroke, so her exhaust was stronger, although her exhaust port opened for the same length of stroke on both sides. The old man put a new valve in her, and she is a pretty slick engine to ride on now. We will be on to her trick next time.

I used to think lots of lead was a good thing, it made an engine smart, and they had to have it to get a train away from a station, but I am converted now, for she pulled better, run faster and rode better when she was set line and line a full year ago.

How does the sand get on top of the rotary-valve in the D 5 or D 8 brake valve? Nothing from the train-line can get up there, as the reservoir pressure is always on top of valve. We find lots of sand in some of them.

JOHN W TROY.

Indianapolis, Ind.

Two Kinds of Air-Brake Standards.

Editors:

The air brake is of greatest interest to those who make it, buy it, use it and repair it, and the interested parties understand it, more or less, usually as classified above. The manufacturers know what is required in braking a train, and they furnish the appliances to do it with. They experiment continually, note results, make alterations, and finally establish a standard design, to be again changed and changed again, but the latest design is always their standard, and always better than the preceding one.

There are some folks who think that the people who make air-brakes don't understand their business. The roundhouse running repair men think so as a rule, and so do a great many locomotive engineers. I saw an old passenger runner step out of the instruction car once, and I heard him address a "brother" this way: "Say, that feller in there said he had twenty-five cars coupled up. It's a fake. He had twenty-five sets of brakes, though, and when he set 'em kinder easy like, with that new-fashioned brake valve, every one of them pistons slid out at the same time, and they all let off the same way, but he can't take twenty-five cars out on the road and do with them what he did in that car. Twenty-five cars! Rats! When I have ten passenger cars some of them have to be bled off every time I make a stop. It's just a scheme to sell that new brake valve, they get more money for it. You bet they can't influence me. If the Old Man lets me keep my three-way cock, I'll get over the road all right with all the air-brake cars I can haul." He kept his three-way cock and "gets over the road," and draws as much pay as any of the "smart Alecs."

Younger runners are not so positive that an equalizing discharge and excess pressure-valve is not a requirement of the times. An extra engineer, who was lately promoted from yard service and who, by the way, used to fire for the engineer quoted above, said to me the other day: "Had a special freight train the last trip, twenty-two loaded cars and all equipped with air and coupled up, finest set of brakes I ever handled, but I couldn't control them. That engine has a three-way cock, and I run by every stopping place except when making emergency applications. If the engine had one of those new improved brake-valves I could have handled the train nicely. Anyone who says he can handle twenty or more cars of air successfully with a three-way cock is talking through his hat. Can't keep your eye on the air-gauge all the time when stopping at a water crane, and the train-pipe pressure fluctuates so with a three-way cock that it is really no use to look at the gauge, and as for hearing the exhaust, if light, you can't. The governor is connected with train-pipe, of course, and as soon as the cock goes on lap, the pump starts up, the engine is usually popping, and with the rumble of the train there is so much noise that you can't tell what kind of an application you are making until you feel the brakes. If you set it strong enough the head brakes will 'kick off' or the emergency go on. With an equalizing discharge valve one can tell almost the exact measure of air he is drawing from the train-pipe by the length of time he allows his valve handle to stay in the service stop position, whether with one or with fifty cars, and in the darkness as well as in the light."

Every railroad company purchases air-brake equipment, but I venture the assertion that not one road in the country keeps its equipment up to the Westinghouse standard. Every road has certain things in the brake line that they refer to as *their* standard, but it is usually something that the brake company discarded for something better years ago. It may be a brake-valve, a triple-valve, an air pump or a form of brake rigging, but master mechanics are led to believe that their old standard form is better than anything later. I say "led to believe," because I know that many master mechanics are influenced by the arguments and suggestions of running repair men, roundhouse foremen and locomotive engineers to a certain degree, and, also, the first cost of an ancient piece of mechanism is always less than that of something newer and better. Running repair men would rather attend to a three-way cock than to a new brake-valve, naturally enough. And having no road experience, they are honest in their convictions that the brake-valve is an unnecessary complication needing constant attention. And the engineers—they are usually the old-timers, who have railroaded the longest and take the least interest in modern improvements. If they get something new they must use it, and to use it rightly, they must understand it, but realizing that "it is hard to teach an old dog new tricks," and that the remaining years of their railroading will be few, they condemn anything not absolutely necessary to taking a train over the road in the old-time way. The prejudiced opinions of some roundhouse foremen and running repair men are of great weight with most master mechanics, and it is the oldest engineers who are consulted by the M. M. or Supt. of M. P. and M. when anything new is to be adopted or rejected, and the oldest men are usually the ones who try the newest appliances. If it lessens their work without requiring any increased mental exertion it is adopted, otherwise rejected. How seldom it is that young runners are approached by their superiors for "pointers."

There is but one *best way* to do anything, and certainly the manufacturers of air-brakes have found, through experiment and experience, the best way to brake an engine and train with air, and they make to sell, appliances to do it with. Using brake apparatus not standard with the manufacturers is a source of embarrassment to the air-brake companies, for if any accident occurs through the use of something they had condemned years ago, the daily papers tell the public that the accident was caused by a "failure of the air-brakes."

In the issue of this paper for August, 1892, Mr. Synnestvedt illustrated a design of tender brake-rigging he had come across, which he regarded as a "freak," and so would anyone else that did not know there were so many of them in use. I commented on it in the following number and the editors called attention to our letters. Last summer, however, this "badly designed brake gear"—which is putting it mildly—was exhibited at the World's Fair under the tender of an engine that attracted attention on account of its immense proportions and modern design. A cut of the engine appeared in LOCOMOTIVE ENGINEERING last summer. She had all the latest improvements—chime whistle, etc. By the way, I have never seen an engine built by the same firm that did not have the same kind of brake gear under the tender. This engine had one of the new Westinghouse brake-valves placed beneath the running board and under the cab, with a rod from it to the engineer's handle in the cab. The original handle of the valve was cut off, enough being left to hold the handle spring, and the handle in the cab also worked with a spring in a notched quadrant just like the one down on the valve, the two springs making the handle hard to operate. When the engine was running, the engineer could not hear the preliminary exhaust or the flow of air from the train-pipe, and he would not know what he was doing but for the gauge, and you can't always watch it. When the engine went into road service, the engineer who run her, condemned the brake-valve.

The handle of those rotary valves should be attached directly to the valve. From the position of lap to that of service stop is a very short distance, and as some of the ports in the valves and seat are in register line and line, it is of great importance that there should be absolutely no lost motion between the handle and the valve. There was no cut-out cock under the brake-valve on this engine, it was set so close to the T connection with train-pipe that there was no room for it. This way of applying air-brake apparatus to an engine and tender was probably a "standard" idea in some one's mind, but whose? Surely not anyone connected with the Westinghouse Air-Brake Co. If railroad officials, repair men and engineers would concede that the air-brake companies know more in their own particular line than *they* do, and bring themselves to conform to the standards of the brake people, there would be fewer air-brake puzzles propounded on paper and fewer air-brake failures in practice.

WILL W. WOOD.

Terre Haute, Ind.

Uniform Air Pressure.

Editors:

I have been waiting for some one who was in the "procession" to take up the question of purposely increasing the train-pipe pressure on mountain grades, but I suppose they are too busy just now to go into this subject, and not being convinced by Brother Alexander's argument, will add a few words just to keep the ball rolling, and in such fashion that others may criticise my methods also. As we are to reason together in this matter, let us see if there are not some reasons why the auxiliary reservoir should not be overcharged indiscriminately as advised. Is there not danger in such cases of imposing a great deal more work on some cars than have been provided for, and in this manner punishing the innocent to correct the guilty? In the first place 70 lbs. train-pipe pressure has usually been accepted as a standard from which basis the braking power is calculated. It is understood that with a service application, with a freight car brake and 8-inch piston travel, the pressure will be about 50 lbs. in brake cylinder and auxiliary reservoir when they are equalized, and while not absolutely correct, my plan in explaining these matters is to assume that the space in brake-cylinder should be equal to one-fourth the space in auxiliary, as, for instance, in ordinary freight service. According to the tests made near Karner, N. Y., in September of 1892, the auxiliary contains a trifle over 1,600 cubic inches, while the brake-cylinder space is 8 × 8 = 64, .7854 = 50.265 square inches × 8-inch piston travel [illegible] or about one-fourth the auxiliary reservoir volume, it is also to be noted that this reservoir reduces about two-sevenths in pressure, when the space has been enlarged one-fourth, and that about two and one-half times the reduction with a service application will be the amount in brake-cylinder, where, say 10 lbs. or more has been poured out from the reservoir, and this pressure will be increased one-fifth under ordinary conditions in an emergency application. Whenever the piston travel has been shortened to less than 8 inches the pressure will rise nearly 2 lbs. for every inch taken off, and when too much piston travel is had, nearly 2 lbs. per inch will be lost for all over 8 inches. In the air-brake and signal instructions of 1892, as approved by the M. C. B. and A. R. M. M. Associations, on page 36, from 5 to 9 inches is the limit allowed in piston travel, making a variation of nearly 8 lbs., so that with 70 lbs. train-pipe pressure and 5-inch piston travel [illegible] lbs., or four-fifths of train-pipe pressure, can be obtained in service stop, and 66 lbs. in emergency, provided the piston travel does not increase with the added pressure. In some experiments, in retaining 15 lbs. in brake-cylinder when released, as with pressure-retaining valves, it was found that with correct piston travel from 4 to 5 lbs. was gained in pressure in service stop in the second application with auxiliary recharged to 70 lbs. This is an increase in power of from one-twelfth to one-tenth. It seems evident, then, that with 5-inch piston travel and pressure-retaining valves [illegible] lbs. could be put in brake-cylinders in service stop and 70 in emergency (the trial [illegible] for service and 67 for quick action, [illegible] I suppose, was less on account of having to overcome the 15 lbs. in brake-cylinder). This, on a freight car braking at [illegible] per cent., with 60 lbs. in brake-cylinder, [illegible] in an emergency give about [illegible] per cent., and it appears from these figures, [illegible] the loss caused in quick action by the pressure retained in brake-cylinder, [illegible] too little is known as yet by the [illegible] to calculate on, that this is not impossible. Now, with 90 lbs. in train-pipe, and [illegible] inch piston travel, the pressure in [illegible] cylinder in service stop would be [illegible] of [illegible] 64 lbs., while with 5-inch piston [illegible] four-fifths train-pipe pressure would be obtained, or 72 lbs. with [illegible] lbs. added [illegible] pressure-retaining valves, making 77 lbs. in brake-cylinder for a service stop. [illegible] lbs. was intended, and if 60 lbs. in brake-cylinder gives 70 per cent. braking power, then an increase of one-fourth in cylinder pressure should increase the percentage one-fourth, which is 17, or 87 per cent. in service stop, while the emergency would give the full pressure, or [illegible]7 lbs. in brake-cylinder, nearly half more than was intended in the beginning, and making this car brake at 96 per cent. This, of course, would be an extreme case in 70 per cent. cars. But what of the freight cars that are now running on some roads, braking at [illegible] per cent. with 8 inch piston travel and [illegible] lbs. train-pipe pressure? With 5 inch piston travel and 87 lbs. in their brake-cylinders they would be braking at about 130 per cent.

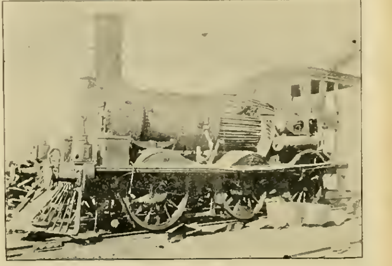
There is also another side to this question, of more importance, perhaps, than the one just presented, that of not carrying sufficient main reservoir pressure to promptly release the brakes. There seems to be no doubt but that on long freight trains there should be ample pressure or volume held in reserve to attain this object. While using maximum main reservoir pressure as maximum auxiliary pressure, is there not in freight trains of any length a tendency for some brakes to stick on much longer than others, so that some may release at once and others, perhaps, not until it is almost time to apply again? With the pressure-retaining valves working, the last brakes released would have lost all but about 15 lbs., and not have received the amount they should have from the auxiliaries if the brakes are used as soon as the first ones are recharged. To avoid this difficulty there should always be sufficient excess pressure to promptly overcome the auxiliary pressure, so that as near as possible all brakes would be given the same time in which to recharge. I once heard a traveling engineer from one of the worst roads in the Rocky Mountains say "their air governors were sealed, because while the engineers said they could let a train down with 70 lbs. of air just as well as with 90, they wanted 120 lbs. in case anything happened," and this logic would probably apply to the case now in hand, in fact, it seems to be the same old plea used by the man who used to screw his pop valves down when he had a hard pull. Neither can I agree with the argument made that excess pressure of 120 lbs. will not charge auxiliary reservoirs through train-pipe from 50 to 70 lbs. as quickly as 90 lbs. constant pressure will recharge from 70 to 90 lbs. With a leaky train-pipe in a freight train (which seems to occur quite as often as leaky piston packing) with the handle in running position and plenty of excess, the Plate D 5 valve would be my choice; in release position would prefer the Plate D 8 valve, because when the time came to release there would be some excess.

There are no doubt plenty of runners who, if there were no occasion to use the emergency-brake, and there were no leaks, and the main reservoir possessed volume enough to release the brakes, would have no difficulty in handling their trains with the brake valve handle in release position and all the air the pump could make, but this combination cannot be counted on always. Another point in this debate that is a little shady is the amount of main reservoir pressure to be carried. It is as apt to be 95 or even 100 lbs. as it is to be 90, at least such is my experience. It seems to be a most opportune circumstance that, at a time when there is apparently a general awakening on the subject of percentage and the condition of foundation brakes, this method of overcharging train-pipes should be brought up, as in all probability those who are on the point of increasing their freight braking-power to 90 per cent. will, when this practice is brought to their notice, take the necessary steps to protect themselves. It may be a little hard on the valve on the start, but I believe when the question is finally settled, the feed-valve attachment will be accepted and carried in running position and with all the main reservoir volume needed. At the present time about the only foundation on which we can build to get the most efficient and uniform service from the air-brake is that of a fixed train-pipe pressure. There can be nothing substituted which will so easily allow different companies to handle rolling stock in unison. I wish also to call attention to the fact that a great many of the driving-brakes of to-day do not equalize at 50 lbs. as between their brake-cylinders and auxiliaries, but at nearer 40 lbs., and that it is useless to inform an engineer that he has got the full benefit of his braking service at 20 lbs. reduction when he can see his driving brakes go on after he has made even 25 lbs. reduction. And, now one more suggestion. Probably when the present pressure-retaining valve was adopted 15 lbs. was enough when the condition of affairs was taken into consideration, but it now looks as though a little more could be added in this line. Referring to the statement made as to retaining 15 lbs. of air, and then recharging, it will be seen that from 4 to 5 lbs. was gained on second application after 70 lbs. had been regained in auxiliary. Suppose the retaining-pressure was increased to something over 30 lbs., so that with correct piston travel, say 10 lbs. would be gained on the second application after recharging to 70 lbs. Of course, in this case the auxiliary would then only reduce to about 60 lbs. This used as a service application would hardly be likely to damage anything, but the time saved in recharging might be valuable. It takes very near the same time to charge from 50 to 70 lbs. as it does to charge from 0 to 50 lbs., that is, say five sevenths of the pressure would be obtained in the first half of the time required for the whole space to charge. Now, say we had made one application, reduced the train-pipe pressure to 50 lbs. and had to recharge while triple-valves were released, the train would not make much headway on account of the 30 lbs. in brake-cylinders, and if it was necessary to apply again so soon as 50 lbs. could be obtained it would take but 56 lbs. in auxiliary, reduced five-sevenths, which is 40 added to the 10 lbs. gained from pressure-retaining valves to get the quantity required. Lack of opportunity has prevented practical experiments in this line, but it seems at present to solve the difficulty experienced in keeping brake-cylinders charged on long steep grades. I can see but two objections to this plan: that concerning quick action, which could not be of much service, but which would hardly be necessary when there was 30 lbs. in brake-cylinders; and leaking apparatus, which should be kept in order any way. While I do not claim that 30 lbs. should be used as a standard, I would like to learn what others think of the plan. It could be tested by turning up a long pressure-retaining valve case, No. 3, Fig. 11, Plate E 34, of the '94 catalogue, and putting in a spring of sufficient strength to make up the 30 lbs. Also, what would be required to prevent trains from breaking in two when brakes were released and a number of such cars were bunched behind those with the standard retaining-valve, or would it be necessary to employ at the start a double valve which in one position would retain 15 lbs. and in another 30.

Roanoke, Va. GEORGE HOLMES.

We will suppose that we have one of these beautiful domes to make. It will be seen in Fig. 115. There are seven pieces or sections in the make-up of this dome—namely: The bell *a* or trumpet, the dome *b* or half sphere, a ring *c* for the dome to rest in, the ovolo *d*, the shaft or barrel *e*, the torus *f*, and the plinth or foot *g*. The first piece in order is the plinth or foot. This should be made of brass of No. 12 wire gauge, and may be made in three ways to accommodate the size of the sheet at hand. If a sheet can be had large enough, the square base may be worked up in one piece by cutting out the corners, and turning up the sides similar to a straight square pan and soft-soldering the corners with cleats or brazing them; but there was no sheet made large enough twenty-five years ago, and so we made them in pieces. I have seen the plinth or foot made in five, and again in three pieces.

We will make the one under consideration in three pieces. Mark out the pattern of the side the size required, as shown in *A*, Fig. 116, which explains itself. Then cramp and fold the two pieces and make them fast with two pairs of dogs, as shown in Fig. 103. Braze them together and trim the joint. We now form it up square, and put a stiff iron cross, Fig. 117, in the diagonals to hold it in position, making it fast with four screw clamps, while we lay off the saddle flange two inches wide, with the flange at the two sides. Now fill in the corners, and sling the work by the iron cross in the center over a narrow saddle forge, Fig. 112, and braze them in. The corners are now finally trued up square, the sides planished, and the upper edge tinned about ¼ inch on the inside ready for the bottom *B*. Cut out the bottom *B*, Fig. 116, making it ⅛ of an inch larger all



EXPLODED BOILER, GOVERNMENT RAILROAD, OF NEW SOUTH WALES.

* Railroad Coppersmithing—IX.

By JOHN FULLER, SR.

REGULATOR DOMES.

The covers for regulator domes have been made in a great many different styles, but as the work is very similar in all except two, I shall only notice these, and let them answer as a guide to all the others. In Fig. 114 is represented one of the prettiest dome covers ever made. In the construction of this cover one is made to encounter some of the most difficult though common geometrical figures, and as they are usually made by hand with poor and scant appliances, it requires skill of a high order to produce them in proper shape. It should be noticed this cover is Tuscan in design; the shaft and plinth or foot is after the fashion of a Tuscan column, the capital being crowned with half a sphere pierced with a trumpet.

round than the square of the foot. When planished and smoothed, tin the edge of this all round about ¼ inch inside ready for soldering. Now make four cleats of thin copper the length of the side; that is, take four pieces of thin copper an inch wide and bend them at right angles ½ inch each way to lay in the corners, and bring the pieces *A* and *B* together, and tack them in a sufficient number of places to hold it properly, while the cleats are being soldered in the corners; then lay a body of solder in the corner, enough to cover the outer edge of the cleats. When the soldering is completed, examine the joint on the outside for any faulty places, which must be made good; if the joint is sound, the ⅛ we left on may now be trimmed off level with the side. Now make a bead, *G*, Fig. 117, and slip it on the edge of the foot all round and soft-solder it to its place on the under side of the flange. We are now ready for the torus or ring *f*. This, it will be seen, is the outer half of a cylindric ring, and may be roughed out nearly to its final shape by hollowing a ring of brass in a suitable hole in a block, as shown in Chapter III, Fig. 21, at *A*. When the desired shape is obtained, it may be planished and smoothed on a suitable T-stake, Fig. 22, or it may be swaged smooth with a tin swage as shown in Fig. 94.

We are now ready for the shaft or barrel *c*. The barrel is brazed together, and when rounded up true is taken to an anvil or a suitable mandrel and the cavetto and and fillet is worked out, the cavetto a good inch deep, and the fillet an inch and a quarter wide, then the barrel is planished and smoothed, and the fillet at each end swaged smooth with a suitable swage, Fig. 118, or it may be smoothed up in a beading machine between two suitable wheels, Fig. 119, similar to a tinner's stovepipe beader; when the fillet at each end is turned about ¼ inch, outside is ready for the torus and ovolo. The pattern of ovolo or under part of capital is shown in *D*, Fig. 120, and *e* is a flat disk ring in which the dome rests. These two parts *e* and *d*, which make up the capital, are put into shape planished, smoothed and soldered together, as shown by *e* and *d*, Fig. 115, ready for the dome *b*, and for which we are now prepared.

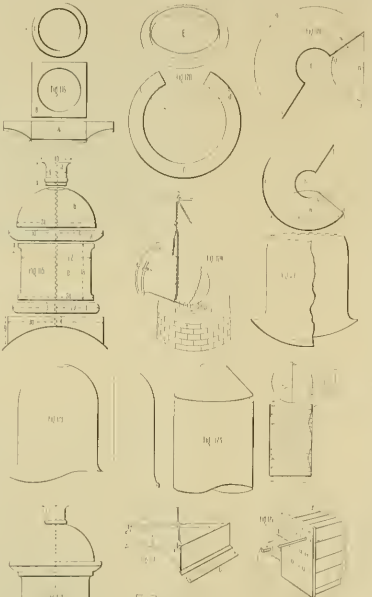
To describe the pattern for this dome, proceed as follows Let *a g f*, Fig. 121, represent the dome or half sphere *b*, Fig. 115. From the edge of the hole *g* draw the line *g f*, also draw the versed sine *a* and divide it at the center, through which draw the line *e b*. With the line *b e* as radius describe the arc *e a e* and measure off on its circumference six times the radius *e f* and draw *b e*, then *e a e* will be the pattern for the half sphere or dome required. Now make the joint, being careful in the folding, and braze it, round up into shape and anneal, when it is ready for the first course. Crimp or wrinkle the edge regularly at the bottom and take it to a mandrel block, Fig. 122, and with a good ash mallet raze in a course, beginning a fourth the distance up the side on the outside, then raze down a course at the top. Now work out a course on the inside toward the center of the side and anneal. Repeat the operation, taking first a course outside and then inside until the spherical curve is obtained, then planish and smooth and tin the upper edge inside about ¼ inch and the lower edge outside about ⅛ inch ready for soldering. We are now ready for the bell.

The bell may be made in the same way as that described for Fig. 99, with the addition of the bead at the lower end, which is worked in with a suitable swage similar to Fig. 118. When the bell is completed the straight part under the bead is tinned ready for soldering to the dome. We are now ready to put the several parts *a, b, c, d, e, f, g* together, proceeding as follows First fit the bell tight into the dome and solder, leaving a full ¼ inch of solder around the joint. Next put *c* and *d* together, leaving a body of solder in the corner of the joint, then fit the fillet of the shaft or barrel tight into the ovolo *d* a ¼ of an inch, and solder it in the same way, leaving the solder level with the edge of the fillet. We now fit the dome into the capital made up of *c* and *d*, Fig 115, and be careful that the bell and dome stand perpendicular and in a line with the center of the shaft, and solder it in. Next make a cleat, *h*, Fig. 120, of light copper 1¼ inches wide—that is, so that it will lap ½ inch on the plinth and ¾ inch inside the torus—and fit it tight into the hole in the plinth *g* and solder it fast, then fit the torus *f* to the cleat and turn it back close to the torus inside. Now fit the lower fillet tight into the torus and solder in the the same way, leaving the solder level with the edge of the fillet. When all is completed clean up and polish. If this work is performed skilfully, and the parts put together true, I believe there is nothing in a railway coppersmith's shop which can give to the workman a greater satisfaction for the labor bestowed than one of this kind of domes.

[illegible] DOMES

We will now proceed with the other cover of which I have spoken, and let me say that, while in a measure the first is a good job and requires a good mechanic to execute it, the cover represented in Fig. 123 requires the greatest skill attainable in this line of work as the cover is brazed together complete, the brazed joint around the crown has always been considered the very zenith of the brazier's skill. This cover is about 27 inches in diameter and 3 feet high, made of brass of No. 12 wire gauge in thickness. To mark out the curve which will fit the boiler when the sheet is turned round, as in Fig. 124, proceed as follows: Let *a b* of Fig. 125 equal the diameter of the boiler, and *c d* equal the diameter of the dome cover. With *c d* describe the circle *c b d g* and divide the circle into sixteen parts, then on the line *h i* lay off a distance equal to the circumference of the circle *c b d g* and divide *h i* into sixteen equal parts. Draw the lines parallel with *h k* to *i n*, then from the points 1, 2, 3, 4 of the circle *a o b* draw the lines 11, 22, 33, 44 parallel to *h i*.

Through the points of intersection draw the curved line *h o p i*, which will fit the boiler when formed into a cylinder. Round up the edges and thin the ends, cramp one end double the sheet, being careful, as before directed, that all spring caused by doubling is taken out before going to the fire, then sling it, jar some borax and water through the cramps, and with a reed, charge the joint, laying the spelter in a zigzag line following the edge of the cramps, which should not exceed an inch in length. Now, be patient, and slowly heat the sheet, each side, on a clean fire, being careful that there is no lead, or salt, or any foreign matter in it (the coke should be clean and about an inch square). When heated enough to bring the borax all down, then with a gentle blast slowly run the joint down, and when cool, clean off and round up on a suitable mandrel. (It will be noticed that the method here given for laying out the pattern, can be adopted and will answer for the pattern of the foot *g*, Fig. 110.) In working out the foot, as previously observed, the most pleasing curve is that of the ellipse, which may be made of any length desired. Having the pattern or template of the curve, which will be one-fourth of an ellipse, commence razing out the foot or flow by a light course with a ball-faced mallet, represented by *F* in Fig. 126, using a thick wooden block (*E*) hollowed out to nearly fit the circle of the cylinder, and sloping off at one end, being rounded nearly to the curve it is desired the foot should be. The block is dogged down to the bench *G* as shown. Let each course taken to raze the foot out be light and the blows regular, annealing at the conclusion of each course.



The top, or crown, of Fig. 124 may be worked with the foot in alternate spells as they are cooling, and thus economize time. When the writer first began making these covers the crown was made exactly half sphere, the same as *b* in Fig. 115, but while in the act of drawing the outlines it was noticed that much time could be saved by taking a wider sheet and tucking in the top end, and borrowing a part of the crown from the barrel, and making the crown smaller, which method was adopted, and the work being much easier performed with less time spent at the fire, and very much less trying to the operator. The difference is illustrated at *C* in Fig. 123, where it is shown that two-sixths of the circle is taken for the crown and the other sixth left on the cylinder, which lessened the labor, and made the work required at the fire not only less but much easier than when the crown was one-half a sphere. I will now form the top or crown, first cutting the pattern and forming it into shape, and then complete the job. Let *a g c*, Fig. 127, represent the crown for the dome cover, which is equal to two-thirds of one-half of a hollow sphere whose diameter is the same as the cylindric part of the dome cover. Draw the line *g c* from the edge of the hole *g*, also draw the versed sine *t*, dividing it in the center, through which draw the line *b e*. With the radius *b e* describe the arc *a e a f* and measure off on its circumference six times the radius *a e*, and draw *b f*, then *e a e f* will be the pattern for the segment of a hollow sphere *a g c*, or the crown of the dome cover, Fig. 123. Now make the joint and braze it, round up to shape and anneal, when it is ready for the first course. Cramp the edge regularly at the bottom as before directed and take it to the mandrel block, Fig. 122, with a mallet take in a course on the head, beginning one-third the distance up the side, then the same at the top, and anneal.

The next course should be enough to bring in the edge at the bottom and also at the top, then take a course out each way to the middle from the inside, which should complete the spherical curve. It may now be smoothed up true, after which the crown is ready to put in. Before proceeding to do this see that the edges are true across their diameter, then thin them with a thinning hammer, after which anneal and clean them either by filing or scraping. Cramp the base part with a chisel, then open the outside cramps regularly with a tweezer, and bring the crown to it and with a cross piece of boiler iron, or two pieces laid across each other, pass a rod through the crown, upon which lay another short piece, the bolt passing through it also. Now screw it up tight, tapping the joint occasionally all round to assist the bolt in bringing the joint up close. Turn it now with the foot up, and in at four opposite places close down four cramps and drill four small holes, putting four brass rivets, enough to hold it while the joint is being closed down smooth—which may be done with the assistance of a helper holding a head inside or by putting it on a head, as in Fig. 128, and balancing it with a weight as shown.

When the joint is ready, take it to the fire and sling it in an endless chain with pulley wheel Fig. 129, hooking it to the traveler over head. Jar some liquid borax through the joint and sprinkle some powdered borax outside, then charge it with spelter all round, warming it gradually as you proceed, and tack it in four places between the rivets and then at the rivets. By this time it will be fairly hot. Go once more around slowly, and when at the place of starting again begin to run the joint with a gentle fire, one cramp at a time. A little help is necessary here to attend to the blast and sprinkle borax on the joint as required. As a hand-hole to use at the fire, two screw clamps are fastened to the foot as shown. When the joint has been brazed and had time to cool, if found to be perfect, it may be cleaned off. The whole job is now finally trued up to shape and planished, first the body, as in Fig. 130, the mandrel curve being rather smaller than that of the dome cover next the foot, and then the crown, as in Fig. 128. Now work in the bead round the foot if required and fill with coarse solder. The cleaning and polishing can and usually is done in a lathe.

The tables below are given for the benefit of the learner and are the latest issued by the manufacturer.

OFFICIAL TABLE ADOPTED BY THE ASSOCIATION OF COPPER MANUFACTURERS OF THE UNITED STATES.

Rolled copper has specific gravity of [illegible]. One cubic foot weighs 558$\frac{125}{1000}$ lbs. One square foot, of 1 inch thick, weighs 46$\frac{51}{100}$ lbs.

[illegible]	Sheets 14 x 48, weight in lbs.	Sheets 24 x 48, weight in lbs.	Sheets 30 x 60, weight in lbs.	Sheets 36 x 72, weight in lbs.	Sheets 48 x 72, weight in lbs.	Thickness in decimal parts of 1 inch.	Stub's gauge (nearest) No.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	35
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	31
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	29
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	24
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	23
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	22
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	21
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	19
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	18
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	16
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	15
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	14
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	13
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

WEIGHT OF COPPER AND BRASS WIRE AND PLATES BY AMERICAN GAUGE.

No. Gauge	Size of each No. Inch	Weight of Wire per 1,000 lineal feet: Copper Lbs.	Weight of Wire per 1,000 lineal feet: Brass Lbs.	Weight of Plates per square foot: Copper Lbs.	Weight of Plates per square foot: Brass Lbs.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

WEIGHT OF SHEET AND BAR BRASS IN POUNDS, BY INCHES AND PARTS OF AN INCH.

Inches	Sheets per sq foot	Square bars 1 ft long	Round bars 1 ft long	Inches	Sheets per sq foot	Square bars 1 ft long	Round bars 1 ft long
1/16	2 7	.015	.01	1 1/16	45 95	4 08	3 20
1/8	5 41	.055	.045	1 1/8	48 67	4 55	3 57
3/16	8 12	.125	.1	1 3/16	51 4	5 08	3 97
1/4	10 76	.225	.175	1 1/4	54 18	5 65	4 41
5/16	13 48	.350	.275	1 5/16	56 85	6 22	4 86
3/8	16 25	.51	.395	1 3/8	59 55	6 81	5 35
7/16	19	.69	.54	1 7/16	62 45	7 45	5 85
1/2	21 65	.905	.71	1 1/2	65	8 13	6 37
9/16	24 3	1 15	.9	1 9/16	67 75	8 83	6 92
5/8	27 12	1 4	1 1	1 5/8	70 35	9 55	7 48
11/16	29 77	1 72	1 35	1 11/16	73	10 27	8 05
3/4	32 46	2 05	1 62	1 3/4	75 86	11	8 65
13/16	35 18	2 4	1 85	1 13/16	78 55	11 82	9 29
7/8	37 85	2 75	2 15	1 7/8	81 25	12 68	9 95
15/16	40 55	3 15	2 48	1 15/16	84	13 5	10 58
1	43 27	3 65	2 85	2	86 75	14 35	14 75

NUMBER OF COPPER BRAZIERS' RIVETS IN ONE POUND.

Nos.	0	1	2	3	4	5	6	7	8	9	10
	148	100	7	44	34	24	18	12	9	6	4

WEIGHT OF ROUND BOLT COPPER, PER FOOT.

Diameter	Weight per foot in length
1/4 inch	.425 lbs.
1/2 "	.756 "
5/8 "	1 18 "
3/4 "	1 70 "
7/8 "	2 31 "
1 "	3 02 "
1 1/8 "	3 83 "
1 1/4 "	4 72 "
1 3/8 "	5 72 "
1 1/2 "	6 81 "
1 5/8 "	7 99 "
1 3/4 "	9.27 "
1 7/8 "	10 64 "
2	12.10 "

LIST OF STANDARD SIZES, WEIGHTS, ETC., OF SEAMLESS DRAWN TUBING.

Inches outside diam'r	Length Feet	Stubs' Gauge	Weights per foot: Brass Lbs.	Weights per foot: Copper Lbs.
1/4	12	18	.11	.11
3/8	12	18	.19	.19
1/2	12	18	.25	.26
5/8	12	18	.31	.33
3/4	12	17	.46	.49
7/8	12	17	.54	.57
1	12	16	.67	.74
1 1/8	12	16	.79	.84
1 1/4	12	15	.97	1 03
1 3/8	12	14 1/2	1 16	1 22
1 1/2	12	14	1 34	1 42
1 5/8	11	14	1 47	1 55
1 3/4	12	13 1/2	1 70	1 80
1 7/8	12	12 1/2 & 13 1/2	1 94	2 06
2	12	"	2 08	2 20
2 1/8	12	"	2 25	2 38
2 1/4	12	"	2 35	2 49
2 3/8	12	"	2 52	2 67
2 1/2	12	10 1/2 & 11	3 45	3 60
2 5/8	12	"	3 70	3 95
2 3/4	12	"	3 80	4 05
3	12	"	4 20	4 45
3 1/4	12	"	4 55	4 80
3 1/2	12	"	4 95	5 20
3 3/4	12	"	5 40	5 65
4	12	"	5 60	6 00
4 1/4	12	"	6 00	6 40
4 1/2	12	"	6 45	6 [illegible]
4 3/4	12	"	6 70	7 15
5	12	"	7 15	7 60
5 1/2	12	10	8 30	8 80
6	12	10	9.06	9 59

IRON PIPE SIZES.

List of Sizes, Lengths, etc.

Same as iron size	Outside diameter	Thickness Stubs' gauge	Length Feet	Weights per foot: Brass Lbs.	Weights per foot: Copper Lbs.
1/8	[illegible]	15	12	.27	.29
1/4	[illegible]	15	12	.37	.39
3/8	[illegible]	13	12	.60	.64
1/2	[illegible]	12	12	.76	.80
3/4	1 1/8	12	12	1.22	1.28
1	1 3/8	11	12	1.63	1.74
1 1/4	1 3/4	9	12	2 52	2.65
1 1/2	1 7/8	9	12	2.94	3.12
2	2 3/8	8	12	4 28	4.53
2 1/2	2 7/8	7	12	5.58	5.92
3	3 1/2	5	12	8.35	8.84
4	4 1/2	3	12	12 21	12 96

An Engine on Fire.

An intensely painful accident happened on the Chicago, Burlington & Quincy last month through the bursting of a cup that was used for feeding kerosene into the boiler. The kerosene ran down the boiler head and was ignited instantly, filling the cab with flames. The train was running at a high rate of speed at the time.

FOOT BRIDGE AT NEW CASTLE, NEW SOUTH WALES, BUILT OF OLD RAILS.

The fireman, Edward Martin, was standing in front of the boiler-head at the time the cup broke, and his clothes were saturated with oil, which was quickly ablaze. He rolled on the cab floor trying to extinguish the flames, and Engineer V. E. Giddings thrust one arm and leg and his body from the cab window, and with the other foot set the brake and brought the train to a standstill. Martin, before the train stopped, jumped from the floor, and, with flames streaming from his clothes, rushed to the water tank, raised the cover and jumped in, extinguishing the flames. Giddings jumped from his engine and rolled around in the wet grass.

Martin was put on a freight train and sent home. His clothes, save his undershirt, had been destroyed by the fire. He was horribly burned and is in a precarious condition. Giddings' left hand was badly burned, and the flames devoured his overalls and trousers, only his drawers saving him from serious injury.

A railway station indicator, which is worked automatically by means of a lever projecting underneath the carriage in position to strike an inclined plane upon the track upon approaching a station, has recently been put into service upon an English railway. The indication is by means of a card bearing the name of the station, and a small bell to call attention to the change.

There has been considerable surprise manifested among other railroad men that the Union Pacific, under the direction of Superintendent of Motive Power J. H. McConnell, abandoned the extension smokebox and returned to the diamond stack. A widely spread belief prevailed that the change was a move backward. Light was thrown upon the change by Mr. McConnell in a discussion at last Master Mechanics' Convention, and it appears that the diamond stack is the most effective spark arrester that has ever been tried for the peculiar coal used by the Union Pacific locomotives. A somewhat amusing proof that the extension front would not restrain sparks when the light Western coal is used was given during the recent coal strike. A railroad company running east of the Missouri River was short of coal, and to help out they bought a few car loads from the Union Pacific. The first engine that got a supply of the fuel started out with a freight train and set the cars on fire six times before she got over the division.

BRIDGE WORK IN THE STATE OF WASHINGTON.

It will be remembered that Mr. M. N. Forney, by some objection to the use of the steam engine indicator, roused a vigorous discussion on the subject at the Master Mechanics' Convention two years ago. Mr. Forney appears to have been only partly convinced by the advocates of the indicator, for during a recent gossip he declared that the instrument was like chewing gum, it has too many limitations.

There must be something more than common about the powers exercised by the coal strikers who have lately been tearing up railroad tracks, destroying bridges and playing havoc generally with railroad property. A morning paper dispatch lately went on to tell that a band of strikers blew up a rail road frog with dynamite and with fiendish deliberation burned up the fragments.

*Diseases of the Air Brake System; Their Causes, Symptoms and Cure.

By PAUL SYNNESTVEDT.

Pressure Retaining Valve.

While this is one of the smallest pieces of apparatus used with the air-brake, it is, on mountain roads, one of the most important. While it is one of the simplest pieces it is one of the least understood. Being so simple it is not very liable to get out of order. This is not really a part of

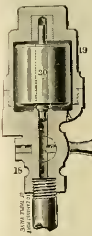


Plate 22.

the brake proper, but is in a certain sense an interference with the normal action of the brake. When the handle is not in operative position it has no effect any more than if it did not exist, but when in operative position (that is when the handle stands at right angles to the pipe) it prevents the entire release of the brakes, holding about 15 or 20 pounds in the cylinder after the triple-valve has released so as to prevent the train from gaining too much headway while the reservoirs are being recharged.

Any dirt on the seat of this valve will, of course, destroy its function entirely. Cleaning is all that is necessary to repair it.

Blow from Retainer.

If the air is blowing out of it when the brake is not set, the trouble is in the triple-valve and not in the retainer at all. If the retainer be missing entirely there is no interference with the primary functions of the brakes, and if a blow be detected at the end of the broken pipe it must not be plugged up, as this will entirely prevent the release of the brakes. This pipe is nothing more than the exhaust from the triple valve, and if a brake blows hard from the exhaust it should be cut out until the triple valve can receive proper attention. For instructions in such a case, see the chapter on "Triple-Valve."

Hose Coupling.

Before taking up the subject of foundation brakes, let us now give a little attention to the hose coupling. The care required by this part is mainly necessitated by wear or destruction of the packing rubber or gasket, which must be occasionally renewed.

With the designs in most common use (shown in Plate 23, Figs. 1 and 2) this renewal can most readily be effected by taking the hose off from the car to some place where the cap on the back can be fastened in a vise and a rod inserted in the nipple as a lever to turn the coupling-body. These caps are generally screwed down so firmly that it is quite useless to endeavor to get them loose while on the car. The average life of these rubber gaskets is considerably shortened by the pernicious habit many trainmen have formed, of hooking up the hose with the point of the dummy coupling right in the port opening. This destructive practice cannot be too strongly condemned.

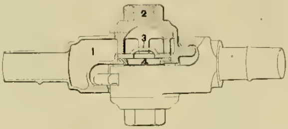


Fig. 1.

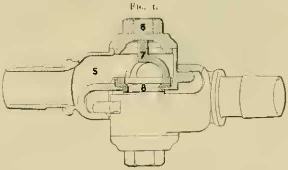


Fig. 2.

Plate 23—Fig. 3.

Westinghouse's Improved Coupling.

This, the latest form introduced, is shown in Plate 23, Fig 3

In this, the gasket 7 is simply inserted in a taper groove around the port opening, the idea being to permit of the renewal of the gasket without the necessity of removing the coupling from the car. The main trouble with this design arises from hardening of the gasket in the groove or rusting of the inner surface, making it difficult at times to clean out the groove, or get a new gasket in so as to make a tight joint.

If, on attempting to extract the old gasket, it breaks in pieces and sticks obstinately, it is best to put on a new hose and take the old coupling to some place where the groove can be scraped out with a tool.

For instructions as to the best thing to do when a leak is detected in a coupling connection, while on the road, see the chapter on the train-pipe.

Foundation Brakes.

Under this head are included all the levers, rods, beams, shoes, etc., that are used in conjunction with the air-brake proper. This is a subject so vast that anything like full consideration of it would require a special treatise, therefore we shall touch on it here only in a very general way. For convenience, let us divide the question into the following heads: Car-Brakes, Tender-Brakes and Driver-Brakes.

Car-Brakes.

Probably the most troublesome disease under this head is improper

ADJUSTMENT OF LEVERS.

Even when the piston travel is right the angle of the levers is frequently wrong. All levers should stand as nearly at right angles to the rods as is possible. Any other position interferes with a proper distribution of the braking power, to a greater or less extent, according as the position of the levers is more or less oblique.

The proper

PISTON TRAVEL

is, for passenger cars, about 8 inches, and for freight cars about 6 inches. A constant struggle should be maintained to keep this as nearly uniform as possible, and any great variation either way will be sure to show itself in the performance of the brakes in service. With too long a travel the brakes will not hold properly, and with too short a travel they will stick.

If the travel be reduced to an extremely small amount all the air admitted to the cylinder will escape through the leakage groove, and the brake thereby be rendered useless entirely.

Let us repeat, too much stress cannot be laid upon the necessity of keeping the foundation brakes properly adjusted. Care in this respect will reduce both the number of wrecks and flat wheels. This applies not only to car-brakes, but to driver and tender-brakes as well.

If levers bend they should be made stronger.

If rods break they should be made thicker.

If beams collapse better ones should be substituted.

What sense is there in spending thousands of dollars for the latest improvements in triples, engineer's valves, or pumps if the braking force developed by them is lost through the breaking of beams, rods or levers? What does it profit a road to put expensive driver-brakes on an engine if they are not kept in operative condition?

No one should remain satisfied with a brake that simply takes hold, it should be made to take hold just as hard as is possible without sliding wheels. It is a good rule not to let a single wheel run without a brake if there is room to put a brake on it, but it is even more important after it is on to take proper care of it.

The author has seen a number of instances where two trains, to all appearances exactly similar as to brake equipment, were stopped on the same track, but showed remarkable differences as to the length of stop, one sometimes running nearly twice as far as the other.

Investigation invariably revealed the fact that the difference was largely due to the condition of the foundation brakes.

Tender-Brake Levers.

Many, if not most of the designs of lever arrangement under tenders are exceedingly poor. In many cases the whole construction may be called one great disease. Such can only be cured by complete reorganization.

About all the engineer can do with this brake is to see that the cylinder is properly oiled, the slack adjusted, and the water frequently emptied from the drain cup. A tender should have about the same piston travel as a freight car (6 or 7 inches).

The modified form of the Stevens system, illustrated in Plate 24, is about the best lever arrangement for tenders. It is simple, compact and easily adjusted, three points of advantage of particularly great importance where the available space is as limited as it is under most tenders.

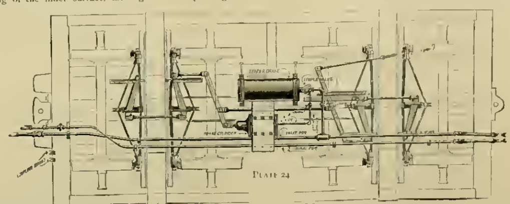


Plate 24

Driver-Brakes.

A good driver-brake is a great boon to an engineer, and if properly proportioned is of greater assistance in stopping a train than the reverse-lever. It therefore behooves the engineer to take good care of it, and in order to be able to do this properly he must make a careful study of the peculiar eccentricities of that driver-brake which comes under his immediate charge, or of all classes of driver-brakes if he has to run many engines. In the latter case it is of course considerable of a task, and better results can be expected where an engineer always has the same engine.

Every driver-brake has its own peculiarities, due to differences in location, and the proportion and arrangement of parts. Some push-down brakes have very long cams, and such generally require frequent

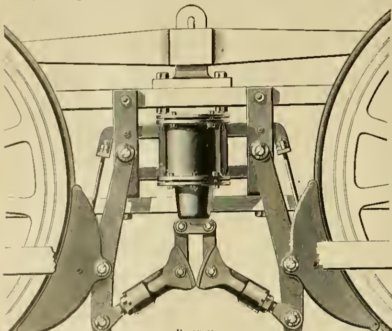


PLATE 25.

adjustment, but if they are allowed to get a little too much slack they will soon take hold too violently and grind or lock the wheels. Some have very short cams, and these will generally run much longer without adjustment. In some the cylinder is closer to the firebox than in others, and as a consequence the packing leather dries out more rapidly, to counteract which it must be very frequently oiled.

Push-Down Brake.

Plate 25 illustrates the most common form of push-down driver-brake. The angle of the cams, when the brake is released, should always be about the same as that shown. The shoe heads should be so adjusted that the shoes will hang with their faces about parallel with the tread of the wheel, except in winter, when difficulty is experienced from ice collecting around and on the face of the shoe, when the head should be so adjusted that the end of the shoe toward which the tread of the wheel moves, shall hang nearer to the wheel than the other end. This will serve better to scrape off the snow and ice. The idea will be more clearly understood by reference to Plate 25a. This rule cannot, of course, be applied to engines which run backwards as much as forwards. It applies equally, however, to the style of brake shown in Plate 26, which is now used very extensively on heavy engines.

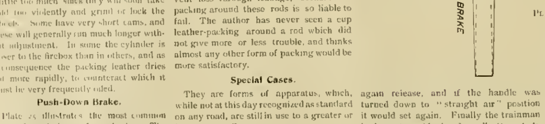


PLATE 26.

Outside Equalized Brake.

In connection with this design, very large cylinders are generally used, and this makes it very important to guard against allowing the pistons too much travel, for this weakens the braking force very materially.

To be sure the auxiliary reservoirs are supposed to be enough larger to obtain the proper proportionate expansion or equalized pressure, but it must be remembered that this calculation is based on a moderate travel of the pistons and not by any means on the full capacity of the cylinders.

These cylinders are generally of the pull-up type, the same as shown in the cut, with a stuffing-box around the piston-rod. This requires constant watching to prevent loss through leakage, because the packing around these rods is so liable to fail. The author has never seen a cup leather-packing around a rod which did not give more or less trouble, and thinks almost any other form of packing would be more satisfactory.

Special Cases.

They are forms of apparatus, which, while not at this day recognized as standard on any road, are still in use to a greater or less extent. For instance

PLAIN FREIGHT TRIPLE

Plate 27 illustrates the third of these special cases. A large number of these valves were put into service prior to the

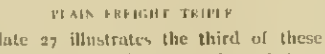


PLATE 25a.

introduction of the quick-action triple, most of them having been applied to cars used in fast freight runs. As far as general construction is concerned it was simply a plain triple with a four-way cock, but because of a couple of weak points in design it has given more trouble to trainmen than, perhaps, any other form of triple ever brought into general use.

BRAKE STICKING.

When one of these brakes refused to release, the trouble would begin. With an ordinary triple this could be easily remedied by letting a little air out of the bleeding-cock. These brakes were not provided with bleeding-cocks. In place of them a groove (shown just to the left of Fig. 4 in the cut) was made in the four-way cock plug in such a position that when the brake was cut out, this channel would connect the cylinder with the atmosphere, and the brake would come off. As soon as it was cut in again, however, it would reset, and so it would continue. When cut out it would release, when cut in again it would set, when cut out again it would

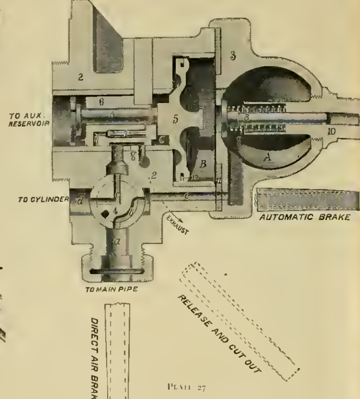


PLATE 27

again release, and if the handle was turned down to "straight air" position it would set again. Finally the trainman in disgust would abandon all attempts to make it work, leaving it cut out when it might have been used had he understood how to fix it. All this trouble arose from the fact that the groove in the four-way cock (through which the brake released when cut out) bled the *cylinder* but not the *reservoir*. As long as the pressure in the reservoir was greater than that in the train-pipe, the main piston was held in application position, while the opening to the cylinder could be shut and the exhaust from the cylinder opened by turning the four-way cock to cut out position.

This would not reduce the pressure in the reservoir, and so, as soon as the valve was cut in again, the brake would reset.

In most of these cases the reservoir pressure could have been reduced simply by moving the handle clear around beyond the straight air position as far as it would go, for this would bring the exhaust groove opposite the port from the reservoir, and allow the reservoir pressure to escape until the piston and slide-valve move back to cut off the opening.

Another defective point about this design was that the piston was not allowed sufficient travel to pull the slide-valve entirely past the opening to the cylinder.

BRAKE REFUSES TO SET.

As a result of the above-mentioned condition, this triple becomes entirely inoperative when the graduating pin breaks, because the air-pressure closes the graduating-valve, thus shutting off the only passage through which air might have reached the cylinder.

There are at the present day many of these valves, which, though in good condition, are allowed to run *cut out* simply because of the lack of a proper understanding of them by the trainmen.

Appendix.

The plates shown under this head are from photographs of various parts of the air-brake apparatus in a diseased condition. Most of them were obtained through the kindness of Mr. G. W. Rhodes, superintendent motive power, C. B. & Q. R. R., but the author's thanks are also due to a number of others, who generously assisted him in making the collection.

PLATE 28.

The first of the set, Plate 28, shows an upper valve chamber bushing, taken from an 8-inch pump, together with a number of disabled air-valves. No. 1 is broken in a manner not at all uncommon, and yet one which, when it occurs in a lower discharge-valve of a 6-inch pump, is very apt to deceive the "doctor," for when he touches it underneath it feels all right, has the proper lift, etc. No. 2 has the head broken loose from the wings and forming a kind of collar around the stem or projection above. Nos. 3 and 4, as will be readily seen, are each broken in two pieces, the projecting knob on top of No. 3 being missing entirely. This knob when broken off frequently wears round, like a little marble, and sometimes causes trouble by getting stuck somewhere in some pipe or port. No. 5, like No. 1, is but very little worn, and serves particularly to emphasize the importance of having these valves made of the very best material. No. 6 speaks for itself.

PLATE 29.

No. 1 (Plate 29) shows a main piston-rod taken from a pump, broken at the upper end where the head was screwed on. No. 2 is a main valve rod and lower piston-valve, with an adjustable stop attached. It is evidently "home-made." If this adjustable stop should happen to be made a little too short, the main valve would travel too far down, the lower small packing-ring expand below the bushing, and the remainder of the trip have to be made with hand-brakes.

Beware of adjustable stops.

PLATE 28.

PLATE 30.

What an interesting trio we have in Plate 30. Nos. 1 and 2 are evidently the result of the coupling being caught and

PLATE 29.

crushed between two cars. No. 3, it will be noted, has the upper lug bent downwards, a condition not infrequently resulting from a blow from a link or pin in the hands of some brakeman, in an attempt to stop a leak.

PLATE 30.

PLATE 31.

PLATE 31.

No. 1 (Plate 31) shows the body of a N. Y. triple-valve, which has evidently received some "hard knocks." No. 2 is a striking object lesson for the men who clean and repair triple-valves. The marks of the hammer clearly show the cause of the crack. When a gasket joint sticks, *persuasion* generally works better than *force* in getting it loose.

PLATE 32.

PLATE 33.

PLATE 32.

Nos. 1 and 2 (Plate 32) are two triple-valve pistons, on which the gum and dirt are "beautifully" shown. The smaller one, No. 2, was taken out of a freight triple on a car, which came in with 4½-inch flat spots on eight wheels, because the brake "stuck."

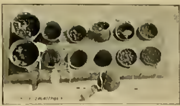


PLATE 34.

PLATE 35.

The lot of emergency-valve gaskets, marked 3, show the effect of neglect and carelessness (particularly in the use of too much oil in the brake cylinder) and graphically illustrate a frequent cause of the "blow from the triple-valve exhaust" about which we hear so much complaint.

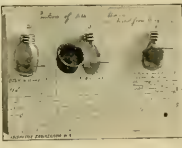


PLATE 36.

PLATE 33.

Plate 33, though not very beautiful is exceedingly instructive.

PLATE 37.

The sections of train-pipe shown, were taken from under a refrigerator car, the pile of dirt numbered 2, being the accumulation skaken out of a piece only 8 feet long.

Pile No. 1 was shaken out of a 16-foot length of *new* pipe, and most impressively teaches the need of blowing out all pipe thoroughly, in setting up new work, before connecting the valves.

PLATE 38.

PLATE 34.

The triple screens shown in Plate 34 are fair samples of hundreds that are running at the present day. They are shown just as they were found. The two large, tin, funnel-shaped extensions shown at one side were put on to hold the dirt found in the pipe next to the screen; the screens not being large enough to hold it all. The accumulations are mostly a mixture of *pipe scale, cinders, sand, sponge, corn,* etc.

The effect of such a condition of affairs can be better appreciated when we reflect that all the air to operate the triple must pass through such a mass of dirt. With some of the samples shown a service application is still possible, but not an emergency stop.

PLATE 35.

Plate 35 illustrates something similar to Plate 34, except that the case is a little more aggravated. No. 1 shows the check-valve case of a No. 1 New York triple-valve, No. 2 a pile of dirt taken from the train-pipe at the union connection, with the screen lying on top.

PLATE 36.

To get some approximate idea of just how rapidly dirt will collect at the triple-valve screens, a dirt collector, in the form of a drain cup, with a strainer like the strainer in the supply-pipe to an injector, was placed on a number of cars just at the triple connection, and the accumulations put in small bottles, which are shown in Plate 36. The amount in the ones numbered 2 and 3 does not show very clearly, so a short line has been drawn to one side of each to indicate the quantity.

PLATE 37.

The attention of trainmen is particularly called to the exhibits shown in Plate 37. No. 1 is a retaining-valve with the exhaust hole plugged, and No. 2 a retaining-valve pipe, which, because the valve was missing, was plugged with a piece of wood. Both of these were taken from cars on which the brake was reported "stuck," and had to be bled off after every application or else remained stuck all the time.

From some imperfection in the quick-action part of the triple-valve there was a constant blow from the retaining-valve or pipe, which some uninstructed brakeman stopped in the manner shown.

PLATE 38.

The most striking curiosity in the air-brake line the author has ever seen is illustrated in Plate 38. It is a car drain-cup, broken open to show the interior, into which some one has stuffed a heavy woolen cloth and pine stick, crushing the screen all to pieces, and almost completely filling the whole of the cavity. It was found just in the condition shown, when the brake came to be overhauled under a general order to examine all the drain-cups, and how it got into such a remarkable condition is a mystery. It is possible some one tried to clean out the cylindrical screen by forcing the woolen rag through with the stick, and that the stick became caught, and not being able to get it out, the pipe was coupled up in a hurry and nothing said about it.

THE END.

An Old, Old Man.

They were lounging in the smoking-room of the club, with no better subject for conversation than the vile character of the cigars provided, when Barnard put new life into the crowd by telling that Baggins had got a new job.

"What is it this time?" demanded Montgomery, "is it superintendent of a sewing-machine factory or teller of a bank?"

"Guess again," said Barnard.

All sorts of surmises were expressed as to the nature of Baggins' latest venture. The guesses varied from locomotive engineer to general superintendent, from store clerk to coal mine manager.

"You're all off," said Barnard. "Baggins has accepted the position of manager of a large cattle ranch in Montana. He declares that he has left railroading in all its branches for ever."

An emotional feeling swept over the party. In far Montana the imaginative accomplishments of Baggins would be wasted upon mountain air. No longer would he sit in this smoking-room and tell of experiences in shops, offices, mines and ships that extended beyond two hundred years.

"It's too bad that we are going to lose Baggins," remarked Benson, "let's pass some resolutions. Say something about versatility of his genius and wonderful turn for catching on to different kinds of jobs."

This suggestion met with no response. After a few minutes of reflective silence Redding remarked, "Baggins must be about 40 years old, yet one evening I took a note of the experience he told about in different positions and it footed 129 years. Baggins was not in much of a reminiscent mood that evening, either."

"The man's greatest peculiarity," remarked Millen, "was in being in several places at the same time. One night some one spoke of an incident of the war time and that started Baggins off. He said that he joined the army shortly after the breaking out of the war, and was in most of the principal battles. Incidentally, he mentioned that he was running an engine most of the time, but the remark of some member the next evening brought out the assertion from Baggins that he was in charge of a gun-boat on the Mississippi for several years before Lee surrendered.

"One evening we were talking about Russia, and Baggins remarked, with a pensive look in his eyes, 'Great country. Only wants push and capital. Plenty of people. I went there the year before the war. Took out fifty locomotives from Baldwin's. Remained there ten years. Bossed the construction of 500 miles of new track.'

"Something was said about Brazil, and Baggins remarked, 'Ah, that's the country to make money in. I went there in '63 and took charge of an ore reducing plant. Had yellow fever twice. Stopped seven years, though.'

"One evening, A. W. Wright, of Chicago, was at the club, and got talking about the exciting times they had on the first Atlantic Pacific survey. 'I can back every word you say about that,' chimed in Baggins. 'I went to California in '65 and the first work I did was pulling a chain on the Central Pacific survey. Exciting times! I should snicker at the thought that I have my own hair. Do you see that mark on my hand? That was a wound from an Indian arrow.'

"On another evening Baggins had said that the mark on his hand was made by the splinter of a shell, and was got when he was helping General Scott to take the City of Mexico."

"After all," remarked the man with a pen for a scarf-pin, "I like Baggins. He is always amusing, is always ready to corroborate another man's lies. The trouble with him is that he is too sympathetic when he hears an Ananias artist distinguishing himself. Baggins always wants to associate himself with every man's experience. If any member were to come in and say he had been in hell, Baggins would remark at once that he was well acquainted in those parts, had in fact been master mechanic of the Hell Central Railroad for ten years."

Several anecdotes were told illustrating the mental sinuosities of Baggins, and then it was moved that the man with the pen pin should write expressing the hope of the club that Baggins might meet with appreciative listeners in Montana, and that he might never be steered into regions less sustaining than the carpet of the Flat Wheel Club Room.

? A. What You Want to Know. ? A.

Don't ask questions that simply require a little figuring to determine, make each question separate. No notice taken of anonymous questions.

(107) M. C., Pomona, Cal., asks: [illegible] built, and by [illegible] By the New York Central & [illegible] River Railroad at their shops at [illegible] N. Y.

[illegible] I. M., Ft. Wayne, Ind., asks: [illegible] packing rings [illegible] than another [illegible] has a tendency [illegible] against the piston, [illegible] before the cen[illegible]

[illegible] W., [illegible], Va., asks: [illegible] emergency- [illegible] fits the stem of [illegible] on the out- [illegible] purposes [illegible] emergency-valve [illegible] on top side? [illegible] understand your question.

[illegible] Minneapolis, Minn., asks: [illegible] arranged to [illegible] to burn hard coal [illegible] grate area [illegible] short, there is [illegible] the front end [illegible] have many [illegible] that I coal one [illegible]

[illegible] appears in [illegible] Please [illegible] means [illegible] county of [illegible] broken [illegible] tinuous [illegible] is the [illegible]

[illegible] M. [illegible] safety of [illegible] safety is the [illegible] tender possesses [illegible] is to carry a [illegible] pounds to the [illegible] so that [illegible] capable of landing a [illegible] great. This being [illegible] to be 5 [illegible]

[illegible] McK., New York, writes: [illegible] by the wheel base of an [illegible] not the distance between [illegible] contact with the rail of the [illegible] drivers? A.—That is [illegible] driving-wheel base. When the ex[illegible] wheel base" is used, it gener[illegible] means the total wheel-base which is [illegible] from the point of contact with [illegible] of the front and rear wheels. We cannot answer the other question.

(109) E. E. M. D., Delaware, O., writes: An engine came in with the receiving-valve of the Westinghouse air-pump stuck and the discharge-valve heated so much that the pipe leading to main reservoir became red-hot. Please explain the cause of this? A.—The pump piston kept churning a small volume of air, and the work done by the piston was converted into heat. Compressing air or any other gas always generates heat, but its effects are not perceptible when the compressed medium passes away with small resistance.

(107) Reader, Waukesha, Wis., says: Mention was made in LOCOMOTIVE ENGINEERING a short time ago of thermo-pile. I have looked up several mechanical books to find out what kind of an instrument it is and cannot find anything about it. Will be glad to get some light through your columns. A.—The thermo-pile is part of an exceedingly delicate heat measuring instrument first brought to popular attention by Professor Tyndall in his lectures on Heat a Mode of Motion. The pile is made up of pieces of metal having different magnetic properties, such as bismuth and antimony.

(108) I. B. Y., Savannah, Ga., writes: What is the difference between permissive and absolute block signals, and which system is best for the safety of train movement? A.—Under the block systems of signaling a railroad is divided up into separate sections called "blocks." Each section is protected by signals. Under the absolute block system no train is permitted to enter a block until the preceding train has passed off. Under the permissive system two or more trains may be on one block at the same time, certain directions being given to the trainmen to be careful. The absolute block system is the safest one.

(109) G. R., Chicago, writes: Firebox side sheets are generally $\frac{5}{16}$ inch thick for all kinds of locomotives. We have engines carrying 130 pounds of steam and others carrying 180 pounds, all with the same thickness of side sheets. Now what I want to know is: if $\frac{5}{16}$ sheet is right for 130 pounds pressure is it not wrong for 180 pounds pressure? A.—The thickness of sheet named has been found to be about right for water that contains scaling ingredients. A thicker sheet is more liable to crack. When the pressure is raised the same strength can be secured by putting the staybolts closer.

(110) W. D. S., Bluefield, W. Va., writes: 1. Is there any rule in the standard code which will not allow a train to pick up its schedule time at the first point after 12 or noon after a new time-table goes into force? A.—There is no rule bearing directly on such a case. When a train starts under an old time card the train dispatcher uses his own judgment whether to let it take up its time on the new time card or to run it as an extra. 2. Where could I secure a train dispatcher's guide? A. The train dispatcher's guide is the Code of Standard Train Rules, which may be obtained from the Engineering Literature Co., East Orange, N. J.

(111) A. F., Santa Rosa, Cal., writes: Not long ago I was asked, Does putting a dome on a boiler increase its capacity. My answer was, that if firing rather heavy and taking steam direct from boiler, steam would be more or less saturated according as water was high or low, and considerable water carried over into engine; while, if a dome were used steam would be dry thus getting the full benefit of the expansive quality of the steam. Was I right or wrong? A.—A dome tends to prevent water from passing out with the steam, but it cannot be said to increase the capacity of the boiler. There are many locomotives running without a dome.

(112) J. A. P., Vichy, Ill., asks: 1. In what position should an engine be to test the blowing of valves with the lever in the center? A. Top or bottom quarter. 2. With engine on her quarter and lever on center, will steam go through cylinder cocks or through exhaust, if valve is blowing? A. To exhaust, and possibly to cylinder cocks if blow is strong. 3. With the lever in center, can engine be placed in any position where steam will come out of one cylinder cock on each side? A.—With a right-hand lead engine, the lever in the center, and both cranks ahead of the axle, it is possible for the valve on each side to open the port the amount of the lead.

(113) A. S., Dennison, Ohio, writes: I was hauling a freight train of twenty-one loads with a Class R consolidation engine, the engine fitted with Richardson valve, with relief cock in steam chest. When running down a grade, at a speed of 35 or 40 miles per hour, the driving-wheels revolving only at the rate of about 15 miles per hour, I had to use steam two or three times to keep the engine from locking her wheels. The engine was in the forward motion, and full stroke, brakes and everything free. A.—We cannot account for this, unless there was so much friction somewhere that the engine could not keep up. Might it be possible that you were mistaken—seems impossible to reconcile with any known laws.

(114) P. S., Wheaton, Minn., asks: 1. Where would the valve be when compression commenced on forward stroke? A.—When the valve closes the port compression commences. 2. How would you place piston and valve if disconnecting a mogul or ten wheeler, where side rod and pin would strike cross-head key if it was blocked in the center of the guides? A.—Push piston and valve clear ahead. 3. At what part of the piston travel is the greatest pressure exerted on the crank pins? A.—At the centers. 4. In running ahead why does the top guide wear most? A.—Because the pressure due to the angle of the main rod is upward when the stroke is in either direction. 5. What is the difference between back pressure and compression? A.—They are the same. 6. When the valve "blows," where does the steam go? A.—To the exhaust.

(115) J. McN., Winona, Minn., writes: I have a steel screw $2\frac{1}{2}$ inches diameter, four threads to the inch. I would like to know how many pounds pressure I can get by using a lever 8 feet long with two able bodied men pulling on lever? A.—In figuring this problem you take twice the radius of the lever turning the screw and multiply that by 3.1416, which gives the circumference traversed by the end of the lever. The product is divided by the distance that the screw travels during a revolution. The screw under consideration has a pitch of four threads per inch, so the screw in one revolution will travel ¼ inch. The problem is then

$$96 \times 2 \times 3.1416 \div .25 = 2412.7,$$

which is the work represented by every pound of pull put on the end of the lever. For practical purposes the large deduction of 75 per cent. has to be made for friction. This leaves only 603 pounds of useful work for every pound of pull on the lever.

(116) J. F. W., Terrell, Tex., writes: My engine is cutting right back driving-flange. The engine is in perfect tram and runs a little too much to the right in front. Can you propose a remedy? A.—There are so many things which may cause an engine to cut certain flanges of driving-wheels, that no general directions may be given. When a back-driver is cutting, it can often be remedied by throwing the head of the engine to the same side, but in the case submitted the head of the engine is said to be running to the same side as the driver that has the cutting flange. We would conclude from this that the engine was low on the right hand side. It might, however, be that the driving wheel which is cutting is smaller than the one opposite to it, and it might be that the driving-box brass was worn thin or the front truck out of tram. All these causes must be taken into consideration and the real cause of the defect judged accordingly.

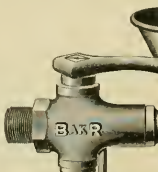
An Improved Combination, or Water-Filling Cock for the Baker Car Heater.

The accompanying cut shows recent improvements in this important attachment to the Baker car heater.

The improvements consist mainly in a simple substitute for the old style threaded joint, of a single thread cut on the neck of the funnel. The entire funnel is cast whole, of brass, as is also the body of the cock, thus making the entire cock most durable, and to consist of three simple parts—the funnel, body and the plug. Heretofore the expense of renewing the tin or sheet-iron funnel has been considerable.

Its special advantages over the old style are the funnel having a horizontal screw-threaded connection with the cock, whereby the funnel is allowed to hang down when partially unscrewed, and is held firmly by the friction merely, when turned up for use. This makes a tight joint, preventing the leaking so prevalent with the old union coupling.

The simple act of opening the cock also opens the air vent. In order to prevent the water from the drum being spilled on the car roof, there is a drip-pipe from the vent from which the water can be caught in the dipper used for filling. Or the drip-pipe may be extended down through the heater closet, so the water will [illegible] under the car.



This new combination cock is fast taking the place of the old. Pullman has ordered it for all of his car heaters, and many other companies are doing likewise. The inventor and manufacturer of the device is Mr. William C. Baker, of 143 Liberty street, New York.

How to Tell Steel from Iron.

In many shops a question often comes up about the nature of a piece of metal—whether it is steel or iron. This is especially true where scrap is used. There is a simple sure way to tell steel from iron, long in use by practical men. Put a drop of nitric acid on the metal, allow it to stay one minute, and then rinse off with water. If the metal is iron, a *grayish-white* stain will be left; a *black* one if it is steel.

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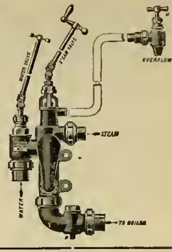

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NIAGARA FALLS EXCURSION.

VIA THE C. H. & D. R. R.

Under agreement of the Trunk Lines, it was decided that no Niagara Falls cheap excursions would be run this year until after the first of August. The Cincinnati, Hamilton & Dayton Railroad will run one of their famous excursions to Niagara Falls at the usual low rate sometime about the first or second week in August. These excursions were discontinued last year owing to the World's Fair, and it is expected that they will be larger than ever this year. Look out for the announcement of them in this paper.

OUR ENGRAVINGS.

Of late we have had a great many inquiries as to who made the fine half-tone plates shown each month in LOCOMOTIVE ENGINEERING. Credit is due the expert anywhere and we are glad to recommend the engravers of our plates to those wanting good work at reasonable prices. All the half-tones and reproductions we use are made by the STAR ENGRAVING & PRINTING Co., 607 & 609 Sansom St., Philadelphia, Pa.

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Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock.

VOL. VII, No. 8. NEW YORK, AUGUST, 1894. 20 Cts. Monthly / $2.00 Per Year.

A Trip in Old Mexico.

[EDITORIAL CORRESPONDENCE.]

FROM VERA CRUZ TO EL PASO.

[illegible] era Cruz one, of necessity, contin[illegible] thinks of Cortez and his little band [illegible] ndering conquerors who came here in [illegible], and with less than 400 men, put an [illegible] under the rule of Spain.

[illegible] is credited with founding the city [illegible] Cruz, and I remember that I was [illegible] that in the little, old, white school[illegible] up in Wisconsin—but it is not true. [illegible] sailed up the river Tabasco, which flows into the Gulf a few miles (three Spanish leagues) above the present city, here he burned his ships and founded a town which he named Villa Nueva de Vera Cruz (the New City of the Real Cross). It is now a small village, the city having been finally located further south.

There are only two available seaports on the Gulf side of Mexico—Vera Cruz and Tampico. The first place has no real harbor, but an open roadstead in front of the city, vessels anchor between the town and the fortress of San Juan de Ulloa, which is on an island about 3,000 feet from shore. All around the Gulf approach can be seen the teeth of the coral reefs as the swell of the waters alternately cover and expose them. It is a very dangerous harbor when there is a "norther" blowing.

For some years the Government have been building a breakwater on the north of the town to form a harbor, this extends out in a semicircle for something like a mile, and is built up of huge blocks of concrete made on shore.

Rinckle and I hired a Greek boatman (the town is made up of people from every quarter of the globe) to row us over to the castle. He showed us, by putting down his oar, how shallow the waters were, the only effect the breakwater has had being the filling of the harbor with sand—they were busy cutting an opening in it hoping thereby to form a current that would again clean out the harbor.

The town is built right down to the water's edge, and the level of the streets only three feet above high tide. Sewage flows through open trenches in the center of the streets, and on account of these there are no continuous sidewalks on the streets running parallel with the shore—when you come to a corner of a block you have to go up the side street about twenty feet where there is a little bridge across the sewer.

There are more stinks and stenches in Vera Cruz than the average man supposes to exist in the known world. Turkey buzzards will eat anything that's nasty enough and are considered here as scavengers, there is a fine of $5 for killing one, and the buzzards know that better than anyone; they are to be seen everywhere, especially do they swarm on the garbage wagons, 30 or 40 of them hover around it, the driver paying no more attention to them than if they were flies. He throws in a barrel of garbage and in a minute the amount is reduced to a peck—they won't eat bottles or hoop-skirts. The Americans there call them the "Sacred Birds" or the "Great Mexican Eagles."

The climate is hot, and yellow fever is never absent, but is worst from May till November.

There are some twenty churches, mostly built in the Moorish style, the Cathedral being quite an imposing structure, it has a large collection of bells—it would be libel to call them a chime, for the Mexicans simply make all the noise they can with the bells. This seems strange, for they are a musical people, every town, great and small, having one or more plazas, and every plaza has a band, and a good one.

Most of the houses are in the old Spanish style, and are built of grout or rubble plastered over and stained and painted in many colors.

The Mexican road only has a small terminal here.

The Interoceanic has a small shop under the charge of Mr. Antonio Sarria, a Cuban, who has been many years in Mexico. Mr. Sarria learned his trade at the Portland Locomotive and Machine Works, in Portland, Me., where he put in seven years' apprenticeship. He was very cordial, and gave us many points about the city, especially where to get good baths. Everybody bathes daily, and some of the bath houses are very extensive and unique, reminding one of the pictures of old Roman baths.

All around Vera Cruz are shifting dunes of sand that drift and change with every wind, large hills moving themselves considerable distances in a few weeks.

It is almost impossible to keep from losing material piled on the ground, any obstruction to the wind causing a drift of sand. Piles of rails are elevated several feet above the level of the ground, yet many a pile of sand shows the ends of rails, pipes, pumps or some other supplies.

Typical Scene on Interoceanic Railway, Between Puebla and City of Mexico. Indian Cultivation of Agave, or Century Plant.

Superintendent of Motive Power W. R. Barclay had kindly sent us transportation to come back to the City of Mexico by the Interoceanic, the narrow-gauge road of the southern part of the country.

We left Vera Cruz about one o'clock in the afternoon with a five-car train pulled by a Baldwin consolidation, and were soon in the sand hills and then among the scraggy growths of tropical vegetation that fringe the desert of sand. Here were growing several varieties of the cocoa tree—those with the huge nut so familiar, and others with great clusters of smaller nuts, coffee, mango and many other strange plants also abound.

The conductor, a young native, was introduced by the American engineer. He was educated at Poughkeepsie, N. Y., and took particular pains to point out all objects of interest.

One of the first of these was at a little station where the track crosses the river Tabasco. Right here below this bridge, the spot where the intrepid Cortez burned his ships, thus saying to his little band of cut-throats "There is no retreat—conquer or perish." Natives yet take out of the river relics of these ships.

JALAPA

(pronounced Halapa), the prettiest town that I saw in Mexico.

From the depot uptown we rode on an open car drawn by six mules, the grade being about 300 feet per mile. The whole town lies on the steep side of a mountain. Two sides of their plaza have high stone walls and steps, the other two being on a level with the streets.

There are only two or three churches, above it in the mountains can be seen the white spires of churches and glimpses of little towns. Jalapa is 4,335 feet above the Gulf.

We left early in the morning, and had a delightful ride up that mountain, twisting and turning, but never going down grade, for some forty miles.

Off to the left, or west, the great Coffre de Perote stood out against the sky. This is a mountain peak nearly 14,000 feet high

big turtles. These were placed under each rail, and a light tie-rod was supposed to keep them from spreading. They made an awful mess when anything got off the track.

After traversing a long stretch of territory, mostly given up to the cultivation of the agave or pulque plant, we arrived at

PUEBLA,

the second city of importance in the Republic and the headquarters of this road and the Ferrocarril del Sur (Mexican Southern).

Puebla was founded by the Spaniards in 1531. It has always been the church stronghold. When President Juarez confiscated the church property, after the French occupation, there were at Puebla—then a city of only 75,000—seventy-two churches, nine monasteries, eleven convents and twenty theological colleges. The Cathedral has the finest and most expensive interior on this continent, if not in the world. Puebla has now over 100,000 people, large manufacturing interests, but still supports sixty-three churches—no monasteries or nunneries are allowed in the country. This is the place where onyx and fine marble goods are made. It is a very interesting city. Almost within the city are the two fortresses that were taken by General Scott, and that were taken and retaken between the French and Mexican forces.

Eight miles away, at Cholula, are the famous Aztec pyramids, made of clay and brick. On top of the largest one stands a church, built by the Spaniards. The pyramid is 177 feet high—quite irregular now and grass-covered—and the base 1,440 feet across.

It seems strange that the Spaniards found here the church-town of the Aztec Empire—and established theirs so near. At that time Cholula had 20,000 houses and 400 temples. It was here that M

[illegible] BRIDGE, INTEROCEANIC RAILWAY, STATE OF MEXICO.

The paymaster's car was on the rear of the train, and we were introduced to the [illegible] of the money. My heart warmed [illegible] the moment I saw him—a tall, straight, blue-eyed young man, with a smile that made you [illegible] [illegible]. One is always glad to [illegible] an Irishman in a far-off country; they [illegible] help to make you feel at home.

"Mr. Hall," said the engineer, "let me introduce you to our paymaster, Mr. Murphy." Mr. Murphy gave me a hearty [illegible] and looked a welcome from his eyes, but said nothing.

"Isn't it a darn shame that an Irishman like him can't talk United States?" said the engineer. But Mr. Murphy [illegible] in his car and we pulled out. His father came to Mexico in the 50's, married a native woman and died there. Mr. Murphy was educated in Spanish, never learned his father's tongue, and spent his young life as a conductor on the old Jalapa tramway. I must tell you about that.

Many years ago an English company built a standard-gauge tramway from Vera Cruz to Jalapa, a distance of 75 miles; this was mostly laid along the Federal highway, there was no grading whatever, it went up hill and down hill same as the wagon road. This line was operated by mule-power and carried freight and passengers, people sleeping on the cars and stopping at stations to eat. It did a large business in taking the natural products of the country to market. It finally fell into the hands of the Mexican Railroad which used part of its lower end for main line, but a great part of the way it was paralleled by the new Interoceanic, and its glory has departed; they were taking up part of it when I was there.

The Interoceanic has a good road-bed most of the way, and follows from Vera Cruz to Mexico the old highway across the mountains. It climbs, climbs all the way. Rinckle and I tried the front of the locomotive, but the extension front end was too hot for comfort, and there were bulls running loose.

The scene changes constantly; one place a plain, the next a gorge; churches everywhere. Tropical vegetation rank and strange. It would worry some of our enthusiasts to see the way orchids waste themselves on the trees here.

Just at twilight we reached the mountain town of

and they are good ones. It is said to be the most Protestant town in the Republic. The people are well dressed, and everything looks prosperous—nice stores and fine hotels. We had the best meal here that I got in the country, and ate it in a bower of flowers that reminded one of the pictures of fairyland.

crowned by an immense square rock. Soon we emerged into a little plateau, dry and dusty, in the center of which stands the now abandoned castle of Perote, once the strongest fortress in Mexico; it is a very large fort with high and strong walls, inside of which many American soldiers died during the Mexican war. The Interoceanic

PANORAMIC VIEW [illegible] CITY OF MEXICO FROM ROOF OF CATHEDRAL—GOVERNMENT HOUSE [illegible] THE [illegible]

There are cotton and woolen mills here, and a large business is done in fruits and other products. It is from this vicinity that the root known in medicine as *jalap* from which the well-known purgative medicine is made, commonly called *jallup* in our country.

The view from the city down the mountain is beautiful, and thousands of feet

people tried to buy it from the government for their general shops, but the deal fell through.

A large part of the road-bed has pressed steel ties. They are used on all curves and make a very permanent track, but it seems not easy to keep in alignment. When the road was first built they employed cast-iron sleepers that looked like

Cortez massacred some [illegible] devils that couldn't get out of the way.

Part of one of the old Aztec temples is built into the front of a now abandoned convent. Some 10,000 miserable people live here now, and pigs roam the streets. But I'm off the track—it's time I got you to the

INTEROCEANIC SHOPS.

. . shops are new, and the . . rail- . . shop buildings in the Republic, built . . and brick, and fairly well sup- . . with tools. This is an English com- . . the shops are laid out on the . . plan, a transfer table between . . shops, a round roundhouse, etc.

. . . BRID . . . RAILWAY, BUILT OF OLD RAIL-

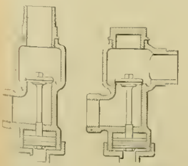
. . of the tools are of English make, . . gh there are some Yankees . . ed some tools that were particu- lar . . wkward; for instance, a large set . . for bending boiler plate, with no . . on for lowering the housing at the end . . tilting the roll. If a complete circle . . lled up on this machine the top roll and . . heet would have to be hoisted out of the . . ime. It was evidently intended for a . . builder's roll, one for making slight bend . . Many of the other tools are as . . , but the majority of them do fairly . .

. . shops are pretty well equipped as a . .

. . road was originally operated with English locomotives, and they have some . . heaps outside, in the graveyard, that are . . artfully and wonderfully made.

They have a class of 10-wheeled passenger engines, with cylinders 16 x 22, that weigh 136,630 pounds, as against 123,000 for the Baldwin 10-wheeler of the same size, the American consolidations weighing only 134,500 pounds.

These engines have not been very satisfactory, don't curve well or stay on the track. They were converting one of them into an eight-wheeler by taking out a pair of wheels, thinking this would lighten her



PRESTON'S BLOW-OFF COCK.

up and give her a chance to let her truck guide her a little.

The most outrageous contraption to be called a locomotive is a class they have . . known to the men as "gunboats." They are six-wheel coupled mills with water tanks on their backs and sides, and coal space at the rear on a short tank. When they came here two of them were coupled together, making a double-ender, a round drawbar some twenty-five feet long went from a cross-piece ahead of the ash pan, through the pans and under the tanks of both engines, the throttles were connected by a ball-and-socket-sleeve-combination that worked both by handling one.

Mr. Barclay and all his men protested that the long drawbar would never hold, but the Englishman who came with them said it would—the bar got hot, pulled in two, and one-half the locomotive ran away the first day. They welded axles into the long drawbars, but it was no good, they finally had to cut them in two and use the ends separate as switch engines.

The covers of their tender boxes were cast on, and there was no possible way to pack a box or renew a brass on the road.

A spring hanger could not be put in without taking off the side tank, and it was impossible to get the side rods off without jacking engine up. There are more trapdoors and subterranean passages around these engines than I have seen in my brief experience. The Southern has some of the same kind and use them for the same purpose—to rust back of the shop.

The boss blacksmith here, Jas. Smith, has devised a special steam hammer die for bending and welding car links, the best thing of the kind I have seen. He promised our readers a sketch of it, and this is to remind him of that promise.

As I said in one of my former letters, every master mechanic in Mexico has a blow-off cock, and J. W. Preston, in charge here, is no exception to the rule, he has what, to my mind, is the best device yet, certainly it works well in service. A sketch is shown herewith.

It's a plain inside opening valve operated by a piston. He makes two shapes, one for the sides of the firebox and one for the belly of the boiler. He connects their little cylinders with piping and a small three-way cock in the cab, and the engineer can open any valve he pleases by simply turning a handle in the cab. This can be done running or standing, thus taking advantage of wind, or a fill, to blow out without getting engine or train dirty. Air can be used, but they use steam there because it requires a smaller piston and is always there if wanted.

This device is worth a United States patent.

General Foreman Eberts has charge of the main shop, and L. Dunbar of the roundhouse. Mr. Dunbar has but recently returned from Peru, where he was for a long time running an oil-burning engine. E. M. Ruth has charge of the car shops,—and that reminds me.

The day I was there Mr. Ruth caused the arrest of the native who was running the stationary engine in the car shops. Some one had stolen one of the large belts the night before. This man was under suspicion, his place searched and the belt found. Natives are born thieves. They were going to make an example of this one.

Here, as on the Mexican, the men draw all the oil they want, and are fined for getting anything hot. Welsh coal is burned out of Vera Cruz and wood out of Puebla.

Mr. Barclay does one thing worthy of being imitated, especially on crooked roads. He connects both goose necks with a cross-pipe with a T in the center, the combination opening being larger than

CONSTRUCTION OF CENTRAL RAILWAY. TRACK IS ON A SHELF ON SIDE OF GREAT CUT, CAUSED BY THE CAVING IN OF THE OLD SPANISH DRAINAGE TUNNEL.

the cross-pipe, then he connects the feed-pipes of injectors the same way, and puts in one large hose right under the drawbar.

The crookedest track hardly moves this hose, it never kinks, and an engine can get off the track and out in the country, the hose will stay there until the drawbar breaks. It requires less hose, fewer joints and the injectors work better.

Americans are employed in these shops only as foremen, the natives are pretty fair workmen when intelligently directed.

In Mr. Barclay's office I met Lon Hendee, the representative of the Westinghouse Air-Brake Co. in Mexico. He was one of the old-time engineers on the Central who came down and helped build the the road out of the city.

Everyone was so cordial here and treated me so well that I disliked to go away, as we got on board the train for Mexico City Mr. Barclay handed me a package, and on opening it I found two boxes of the finest cigars I ever put a lip over—that's the country for good cigars, anyway. I shall always remember that visit with pleasure. I only regretted one thing, and that was that I got no chance to get Mr. Barclay to talking of personal reminiscences; he has been in Mexico for 30 years, and through a great deal of war and revolution—as interesting to me as hot bran mash to a lean sow.

THE SOUTHERN

is another narrow-gauge road, English company, and is much like its neighbor. I did not go over it, as it reaches south toward the Pacific into the hot country.

They use an English engine much like the Interoceanic's ten-wheeler, but made by Kitson at Leeds, instead of Dubs, they are much the better engine and do very good work.

Their gunboats are, if anything, a little worse.

Superintendent of Motive Power H. E. Walker, kindly opened the front end to let me see the arrangement, the steam pipes were $2\frac{1}{2}$ inches outside and the exhaust pipe runs nearly straight across from one cylinder to the other with an opening in the center for exhaust, nothing to prevent the exhaust from one side going over to play horse on the wrong side of the opposite piston.

Mr. Walker has some American engines and is in love with them, though he is an English mechanic sent there from England, he says the American engine is adapted to the work, the English is not.

He is not very enthusiastic over painted jackets, as one would expect, in the bad water and hot climate it is very difficult to make varnish stand on them.

Mr. Walker is also disgusted with the combination check and injector on the boiler head, and rather laughed at me for advocating an internal feed-pipe. He is taking theirs out and running an outside

PANORAMIC VIEW OF ZACATECAS, FROM THE CENTRAL MEXICAN TRACKS.

feed-pipe to a check on the side of the boiler, but I think most of his trouble came from the injectors he uses, think a Yankee injector would help him out.

The shops are good, tools scarce, but

[illegible] to [illegible] up Gen- [illegible] McCam[illegible] is an en- [illegible] and in several places [illegible] No. 2 framed and [illegible]

[illegible] queer-looking freight [illegible] make here [illegible] with the air-brake was [illegible] the shop proper, a roof only covers the wheel lathe, for instance.

The place is kept clean and in order, but the scrap pile behind the shop is appalling until one gets used to it.

Mr. Johnstone is an ingenious designer, and was working over the drawing board when I was there.

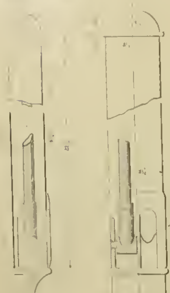
[illegible] Central [illegible] Yards, City of Mexico.

[illegible] new to [illegible] con- [illegible] cause a cer- [illegible] nest [illegible]

[illegible] back to Mexico [illegible] hot and cool off, [illegible] make one [illegible] shop.

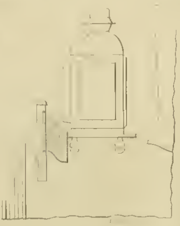
[illegible] these shops [illegible] yard. Mr. [illegible] right of the [illegible]

[illegible] the water tank, [illegible] a stone tower [illegible] tank, made by [illegible] through in- [illegible] is wanted an [illegible] tanks are in general use on most of the roads in Mexico.



[illegible] Flag-staff Holder.

The shops are brick buildings, far too small for the purpose, but having ample grounds around them. Many tools are placed and operations are carried on out-



The blow-off cock used here is good, perhaps the best one operated by hand. It is Mr. Johnstone's, and is made and sold in the United States by the Crosby people.

Bad water calls for improvements on lines that would never be thought of in a good-water country. Wash-out plugs are a source of annoyance on any road using them much. The constant use of the nozzle mars the thread in the sheet, and this must be often tapped out to true up the thread; then there is a shoulder on the plug that don't go down to a fit. Threads are often crossed or stripped being so fine, and coarser ones can't be used in so thin a sheet. Mr. Johnstone overcomes that by screwing in a raised brass boss through which the usual sized wash-out hole is bored, no threads. The face of this is ground to a ball joint and the outside is threaded. A plain brass cap, internally threaded, covers it, and has a hole through the center that keeps in position by a short stem a loose valve that always seats. No wrench is used, but three lugs are cast on the cap, and it can be tightened or loosened with a tap or two of the hammer. Wash-out plugs are very often located where a wrench cannot reach them. The nozzle cannot mar these threads, coarser ones can be used, and the whole thing is safe and reliable.

Our illustration shows a form of this plug used on the wagon top, having a pressed sheet-metal cap covering the hole in jacket, held on by a light tap bolt screwed into the stem of the valve. The signal flag arrangement that is standard on this road is an excellent one, well worth imitating in the States.

Our illustration shows the device in detail. The flag staffs are made of copper pipe (Mr. Johnstone told me he was going to change to wood as the natives stole the copper), hinged at the bottom so as to drop from an upright position to an angle of 45 degrees; there are two of these side and side, one having a white, the other a red flag, and both covered by a Russia iron cover. When no signals are used the flags are kept clean and dry and ready for instant service under the cover, and a flag of either color can be displayed in a second by lifting the cover, dropping the flag out and replacing the cover again. The beauty of the thing is that the flags are always where wanted, can't be lost and are kept clean.

The store-room is very large, the department carries about $1,000,000 worth of supplies.

Natives stealing hose from freight cars has caused them to arrange cars without hose. The train pipe has a regular hose-coupling screwed on to it at each end of the car, and the crews carry long "monkey hose," with a head at each end, to couple cars together. Three fourths of the freight equipment has Westinghouse brakes.

They have here many curious looking engines, the Fairlie bogie and the big double-enders being not the least noticeable.

Some old engines in the shops were being lengthened out. There were many cylinders of compounds about, looking large and oversized.

The big double-enders had been breaking their side levers and new and heavier ones of cast steel were being made for them.

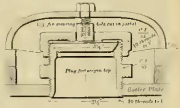
The Leach sander, or a home-made modification of it, is used on some of the engines and was originally located in the pipe just above the running board, but was found not to work so well there as up at the box.

The Belpaire boiler seems to be the favorite form now on this line.

Master Mechanic Sedgwick is a hustler, and has a long experience in handling Mexican labor. He can tell you interesting stories of the early days of railroads in Mexico, and is one of the kind of men one likes to meet.

Mr. Sedgwick was just finishing up a very neat and efficient machine for boring out car brasses, made from an old bolt cutter.

The finest scenery on this line is on the Tampico branch, running from that seaport to the main line at Aguas Calientes (hot water). Here is where their 4 per cent grades and sharp curves are. The double enders were designed for the mountain section of that line. I did not go over it, but bid my friend Rinckle good-bye at the Central station and stayed right on the train until I saw the Stars and Stripes at El Paso, Texas.



Wash-out Plug.

The ride from the City of Mexico to El Paso is a long one. It is 1,224.1 miles, most of it over a dry, dusty waste of chaparal. The time is slow. We left the city at 9 P. M., and rode steadily three nights and two days in this trip.

There are many points of interest on the route, and always something strange and interesting to buy at the stations.

At Zacatecas the road runs back and forth, and circles around through the city and mines are on every hand, right in the streets and yards; the town is built over a silver vein that has been deeply worked for years. It is very interesting and strange.

But one really feels better when you get across the river. El Paso is not so unlike Mexican towns and there are about as

Manuel Gonzalez Tank, for Irrigating, Near Guanajuato, State of Same Name. 100 Feet High.

many Mexicans there But you go into the bank and exchange your "dobie" dollars for Uncle Sam's promise to pay—giving two for one People answer in plain English. The policemen carries a club, instead of a sword, six-shooter and a lantern. You sniff the morning air and remember something—you are hungry—a gentle breeze brings you a breath of home—yes, it's ham and eggs frying somewhere, you follow that scent.

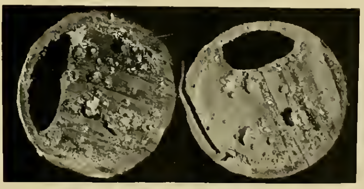
At a turn of the street the lazy wind stirs the old flag, she lazily reaches out a corner as if for a friendly shake, you take off your hat and—well, you are real glad you're back in God's country again.

J. A. H.

Strange Destruction of Flues in a Collision.

Photographic reproductions are here given of the side and end views of some flues that failed under peculiar circumstances

From Photograph of a Flue Melted Down in Service.



Sections of Flues Just Back of Where Melted, Nearly Full of Metal.

On December 20, 1890, engine "95" on the East Tennessee, Virginia & Georgia Railroad had a rear end collision. She was not taken into the shop for almost a year, Dec 14, 1891, and was turned out on Feb. 11, 1892.

A portion of Division Master Mechanic Stone's letter to his superintendent of motive power will best tell the story.

"I send you herewith a few pieces of burned flues taken out of engine '95' * *

"The flues in the boiler looked so good at both ends I thought at first I would not take any of them out, but afterwards thought best to take part of them out, from center to bottom of boiler, to get the mud out, if there was any in the boiler, and commenced to take out the center flues first, and found that they would not drive out. Only one end would start, and flue would drive into boiler and would not start the other end. After trying a few of them and they all drove alike, I knew there was something wrong, and ordered the steam pipes and dry pipe taken out, also all of the flues, to find out what was the matter, and found something I had never seen or heard of before.

"Forty-five of the flues were burned and melted nearly all away in the center of the boiler, leaving about three feet on each end of the flue perfect, and the flues in sheets in both firebox and smokebox in good condition, and neither of the flue-sheets damaged, or any of the other sheets in firebox. There were five rows of flues all around the outside, next to shell of the boiler, in good condition and not damaged.

"The fire was extinguished in firebox as soon as it could be after the collision, and there was no fire around the engine to damage anything, as the shell of the boiler was found, after testing it, to be all right, seams tight and none of the rivets loose, and the paint was not burned off the sandbox, bell frame, dome casing or hand rail, and part of the lagging still remained on the boiler. The engine did not turn over, but stood on her wheels and on the rail all right after the collision

"The only cause I can give is that gases became ignited and burned and melted the flues. I would like very much to have your opinion of it, as I never heard of a parallel case.

"The general condition of flues taken out was good. Very little mud was in the boiler, and none between the flues in the center of boiler where the flues were burned.

"The distance from center to center of flues is 2¾ inches, space between them, up, down and sideways, ½ inch. The flues were slightly scaled on the outside, and I send you three pieces of the scale that came off the outside of the flues, so that you can see the thickness of scale on the flues."

We have shown these tubes to many men of large experience, but have received no satisfactory explanation of how this could occur. It will be noticed in the end views the flues are nearly full of metal that ran in when the melting took place.

The long piece of tube has thin parts of other tubes welded on to it, and is itself as thin as paper at the edges.

The tubes used on this road are iron, and mostly of the National make.

We should like some expert opinions on this subject.

Long vs. Short Valve Travel.

The following highly fair criticism of our article on "Short and Long Valve Travel" is made by Mr. C. H. Quereau, engineer of tests of the Chicago, Burlington & Quincy Railroad:

In the editorial on "Short and Long Valve Travel," it is argued that because Mr. Philip Wallis' test showed no superiority for 5½-inch valve travel over 5-inch, it is fair to assume that long valve travel has no advantage over short in service, though it is admitted that theoretically the long travel should be more economical I am quite sure that all the conditions of Mr. Wallis' tests were not known, or such a broad conclusion would not have been drawn. The tests were made in freight service. No average speed is given, but it is probably safe to assume that it was not over twenty miles an hour. It is very doubtful if the editor would be willing to accept as conclusive, the argument that because 5½-inch valve travel showed no economy over 5 inch travel in a test made in freight service with an average speed approximating twenty miles an hour, it therefore follows that the longer travel will show no economy in passenger service at an average speed of forty miles an hour. This is practically the conclusion drawn, as the paper criticised for advocating long travel treats of "Steam Distribution for High Speed Locomotives."

In the report of Mr Wallis' tests, to which reference is made, attention is called to the fact that the shorter travel gave a practically perfect steam distribution; that the admission line showed a pressure approximating 96 per cent. of that in the boiler, and that there was almost no back pressure Under these circumstances even "theory" would hardly expect any appreciable gain by increasing the valve travel. But rather the contrary, as it must be admitted that the longer travel absorbs more power than the shorter. This report was made in November, 1886, and did not include dynamometer or fuel records. In September, 1887, a report was made by his successor, which gave the results of a comparative test of 5-inch and 5½-inch valve travel, made in freight service with a dynamometer car, and included the amount of coal burned. It showed that the 5½-inch travel produced a dynamometer horse power hour for 5.71 pounds of coal, while the 5-inch travel required 6.9 pounds to produce the same power.

It certainly would be unwise to claim that more economical steam distribution could be obtained by increasing the valve travel, when the valve gear in service gave practically perfect results. It would seem to be equally unwise to conclude that, when the existing distribution was considerably less than perfect, an increased valve travel would not produce economical results in service, when theoretical considerations admittedly point to the conclusion that it would. An intelligent use of the indicator would materially help in deciding whether a given valve gear would be improved by increasing the travel or not.

Union of the Mechanical Associations.

The recommendation which President Hickey made, at the last Master Mechanics' convention, favoring the consolidation of the Master Mechanics' and the Master Car Builders' Associations, and some newspaper writing in the same line, have led to considerable discussion of the subject among the individual members of the two associations. There appears to be considerable feeling upon the question, and we have yet to find a half dozen of the persons immediately interested who favor the change It does not appear to be generally known that a movement of this sort was started several years ago, and led to some action in 1882. A committee of the Master Mechanics' Association, consisting of F. M. Wilder, James Sedgley and Wm. Woodcock, was appointed to confer with a committee of the Master Car Builders' Association, to see if something could not be done to consolidate the two associations, or to arrange for joint meetings. The Master Mechanics' committee was quite favorable to drawing the two associations closer together, but the Master Car Builders' representatives firmly opposed the change, and nothing came of it.

The consolidation of the two associations is very much like the joining of two people in marriage. It cannot be done without the consent of both parties. There are a number of matrimonial agents very anxious to bring about this union, but the principal parties to the contract are sternly opposed to closer relations. So long as this sentiment continues, it will be wasted effort for people to urge forward consolidation. Even if one party to the contract was willing, and the other kept aloof, the union would be no nearer consummation than it was before "Barkis" was willin'. This is a case where Peggotty's sentiment cannot be ignored.

Conflicting Opinions on Common Devices.

As we were sauntering along the porch of the hotel where the last Master Mechanics' convention was held, we found one of the members sitting in deep reflection Rousing slightly on our approach, he startled us by the question, "Is it Shakespeare or Burns, or what writer is it who says that 'all men are liars'?" We named another authority for the broad expression about mankind, and then ventured to ask what had suggested that line of thought. Had he been listening to the tales of the veranda?

"Well, no," he answered "The discussion which I have been listening to in the convention on spark arresters has convinced me that there must be some prodigious lying going on. One man is all for the extension smokebox, and attempts to prove that it saves coal prevents sparks, makes the engines steam better, and is, in short, an all-round benefit to railroad companies. Another man has no use for extension fronts; says he has tried them and has proved that they are no good, but that all the merits claimed for them are to be found in the short front and open stack A third man finds that the old rejected diamond stack has been rejected without cause, and that nothing better can be found as a spark arrester and aid to unrestricted combustion of fuel Then there are a lot of others who have fad notions about choke smokestacks odd baffle plates, and I don't know what Now these fellows cannot all be telling the truth. Where is safety to be found among the conflict of statements?"

This is a species of talk that is to be heard at the close of every meeting where mechanical men discuss subjects and express views that do not harmonize We think, however, that a little charitable reflection will lead to the conclusion that different results may be caused by a difference in conditions. In the matter of spark arresters, almost all the diversity of experience may easily be attributed to the different circumstances under which the appliances are used The difference in fuel alone may account for all the diversity of experience with various spark arresters It is never safe or sensible to insinuate that a man is a liar or a fool, because he tells of experience different from that which has come to his neighbors Perhaps the results he has found have been due to exceptional attention and good management. Devices that are put on and left to run themselves give very different performance from those that are watched and cared for with intelligent vigilance.

Railroads in the Wrong Places.

When you see the words Boston & Albany you naturally think of the road from the Hub to the Hudson, but there is a Boston & Albany of Georgia

Who'd suppose that the Bangor & Portland was anywhere but in Maine. It's up in the interior of Pennsylvania

The Oregon & Texas begins on the line of the Fall Brook road and runs up to a tie camp. The only two stations on the road are named Texas and Oregon

The Secretary of the Railway Master Mechanics' Association has received enough M M. badge buttons to supply all those who did not get them at last convention. Application should be made for them by those who did not receive buttons.

The Elements of Boiler-Making—V.

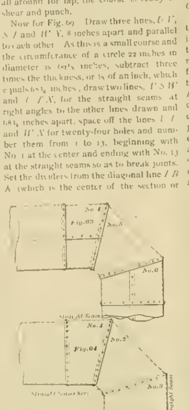
SHEET-IRON WORK.

By C. E. Fourness.*

[illegible] elbow of three [illegible] center and made [illegible] very good el- [illegible] pieces, re- [illegible] and rivets, [illegible] and cost of [illegible] occu- [illegible] the currents in [illegible] are diverted [illegible] little loss of [illegible] striking the [illegible]

[illegible] the elbow [illegible] the [illegible] method of con- [illegible] although it is [illegible] courses, [illegible] out- [illegible] Fig. [illegible] the lin- [illegible] the straight [illegible] are not nec- [illegible] required for [illegible] necessary is the [illegible] and 67, which [illegible] By [illegible] line *A B C*, then [illegible] apart, parallel, [illegible] *A B* and *I J*, [illegible] parallel, and [illegible] decide how [illegible] and find the [illegible] describe [illegible] *M*. Draw [illegible] and *K M* [illegible] *M* in- [illegible] through *O*, the [illegible] the center, [illegible] point of [illegible] these are the [illegible] the dif- [illegible] *C D*, can [illegible] that the [illegible] course is [illegible] inch [illegible] 1¼ inches, [illegible] inches from [illegible] Draw a [illegible] and [illegible] off the [illegible] into thir- [illegible] number them [illegible] No. 1 at [illegible] Draw [illegible] division, [illegible] and *O P K* [illegible] inches from [illegible] with the radius [illegible] which space off [illegible] and number them from [illegible] beginning with No. 1 at *H* and ending with No. 1 at *G*. Draw ordinates through the points of division, just cutting the line *N I K* and *H F G*, continue these ordinates through Fig. 66, connecting the points where the similarly numbered ordinates in Figs. 66 and 67 cut the lines *N I K* and *O P K*. Draw the diagonal line *I B K* through the center, K, and the third point of division of the quadrant. This completes the outline view, and I will next proceed to lay out the sheet to form the large square course No. 1, Fig. 64, by first finding the circumference, 22 x 1/1 69⅛ inches. As this is a large course and No. 10 steel used, ⅛ inch thick, add ⅛ 4 69⅛ 69⅜, the circumference, consequently draw *O P* 69½ inches long, ½ inch from the side, and locating *O* ½ inch from the end of the sheet, draw *R Q* 12 inches from, parallel to, and the same length as *O P*. Draw the lines for the straight seams *O R* and *P Q* at right angles to *O P* and *R Q*, space off these latter lines for twenty-four holes, and draw lines through these points of division, making them at least 18 inches long, and extending them beyond the line *R Q*. Number the lines 1, 2, 3, 4, etc., beginning with No. 1 at the straight seams. Next transfer the lengths of the ordinates between the lines *O E K* and *J C D*, Fig. 65, to the similarly numbered lines in Fig. 68, measuring from the line *O P*. Space off the straight seams for four holes and, after drawing a line ½ inch outside the holes all around for lap, the course is ready to shear and punch.

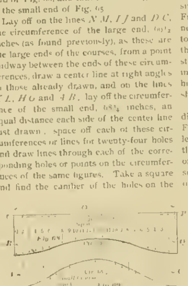
Now for Fig. 69. Draw three lines, *U T*, *S J* and *W V*, 8 inches apart and parallel to each other. As this is a small course and the circumference of a circle 22 inches in diameter is 69⅛ inches, subtract three times the thickness, or ⅜ of an inch, which equals 68¾ inches, draw two lines, *U S W* and *T J V*, for the straight seams at right angles to the other lines drawn and 68¾ inches apart, space off the lines *U T* and *W V* for twenty-four holes and number them from 1 to 13, beginning with No. 1 at the center and ending with No. 13 at the straight seams so as to break joints. Set the dividers from the diagonal line *I B K* (which is the center of the section or course) to the lines *O P E* or *N R I* to find the length of the ordinate No. 1. This length lay off each side of the center line *S T*, Fig. 69, on the line No. 1. Set the dividers again from the line *I B K*, Fig. 66, to the line *O P E* on the ordinate No. 2. This length mark off on both lines No. 2, Fig. 69, and on each side of the center line *S T*, measuring from the latter line. Set the dividers from the line *I B K* to *O P E*, Fig. 66, on the ordinate No. 3. This length mark off on both lines No. 3, Fig. 69, measuring from the center line *S T*, and marking on each side of the center line *S T*. Proceed in the same manner until the lengths of all the ordinates are transferred to the similarly numbered lines in Fig. 69, after which space off the straight seam for two holes, and allow ½ inch all around outside of the holes for the lap, the sheet is complete. I will not lay out the other, the No. 3 course, as it is exactly similar to Fig. 68, but I will proceed to lay out the elbow of taper courses, the side elevation of which is shown in Fig. 63. I would state that this is the form of construction generally followed.



I will outline all three sections at once and will draw two lines, *A B* and *C D*, Fig. 70 parallel to each other and 12 inches apart, as that is the distance *C* and *P* are apart (Fig. 65) and is the average length of the course. I now draw three lines, *H G*, *E F* and *I J*, Fig. 71, parallel to each other and 8 inches apart, as *P* and *R* are 8 inches from the center line *I B K*, Fig. 66, and *P R* is the average length of that course.

Next draw two lines, *H L* and *N M*, Fig. 72, 12 inches apart and parallel to each other. Notice by referring to the outline view and Fig. 63 that the end *A* of Fig. 67 is the large and *R* is the small end, that *R* is the large end, and *P* the small end of Fig. 66, and that *P* is the large and *C* the small end of Fig. 65.

Lay off on the lines *N M*, *I J* and *D C*, the circumference of the large end, 69½ inches (as found previously), as these are the large ends of the courses, from a point midway between the ends of these circumferences, draw a center line at right angles to those already drawn, and on the lines *K L*, *H G* and *A B*, lay off the circumference of the small end, 68¾ inches, an equal distance each side of the center line just drawn. Space off each of these circumferences or lines for twenty-four holes and draw lines through each of the corresponding holes or points on the circumferences of the same figures. Take a square and find the camber of the holes on the small end of Fig. 70, and the large end of Fig. 72, as those ends attach to an ordinary course, and the rivet holes are to be punched at those points. In Fig. 71 find the camber at the line *E F*, but average it by starting at the seventeenth line from each side and work from these to both the center and the outside, and in transferring the lengths of the ordinates to these lines, measure from these intersecting marks, not from the line *E F*. By referring to Fig. 63, notice the straight seams are on the side or quarters, this is a decidedly better place for the seams than on the front or back, as the sheet does not flange on the sides and there are rivets enough in the seams to hold it good and firm.



The straight seams in the Nos. 4 and 5 sections (see Fig. 63), are on the front side or on ordinate No. 7, consequently begin to number the radial lines in Figs. 70 and 72 with No. 7 at the straight seam *A D* and *K N*, number then 7, 6, 5, 4, 3, 2, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 12, 11, 10, 9, 8, 7 at the other end, and for Fig. 71, as the straight seam comes on the opposite side, begin to number them from the other end or line *G F J*, begin with Nos. 7, 8, 9, 4, 3, 2, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 12, 11, 10, 9, 8, 7 again at the straight seam. Next convey the lengths of the ordinates between the lines *J C D* and *O P E*, Fig. 66, this will give the holes on the line *O P E*, but first find by comparing the length of these with the correspondingly numbered ordinates between the lines *V R F* and *G A H*, Fig. 67, that they are an equal length, consequently it will be necessary to only obtain the length of the one ordinate for both sections or courses. Set the dividers on ordinate No. 1 to the distance *J O*, Fig. 65, then set one leg at the center of the rivet hole on the No. 1 line, Fig. 70, and make a scratch or mark across the other end of this line, set one leg across at the center of the rivet hole on the line No. 1, Fig. 72, and make a mark across the same line with the other leg of the dividers, this will be the center of the rivet hole in that seam. Set the dividers to the length *J O*, Fig. 66, on the ordinate No. 2, and transfer this length similarly to both of the lines No. 2, in Figs. 70 and 72, proceed in the same manner to convey the lengths of the ordinates to the correspondingly numbered lines in these figures, then, after spacing off the straight seam for three holes and allowing one-half inch all around outside of the holes for lap, those two sheet are ready to shear and punch.

Now for the middle section. Set the dividers from the line *I B K* to *O P E*, Fig. 66, on the ordinate No. 1, carry this length to line No. 1, Fig 71, and as this is the seventh line from the side set one leg of the dividers on the line *F E*, at intersection with line No. 1, and make a mark on the latter line, each side of the line *E F*, with the other leg of the dividers. Set the dividers from the line *I B K* to *O P E*, on the ordinate No. 2, Fig. 66, and setting one leg at the intersection of the short mark with the two No. 2 lines, Fig. 71. Just on the line *E F*, that outlines the camber, make a mark toward both the ends of the lines No. 2. Set the dividers again to the length of the ordinate No. 3, between the lines *I B K* and *P E*, Fig. 66, and convey this length to the two lines No. 3, Fig. 74, measuring from the camber or curve mark and mark both ends of the lines, proceed in the same manner until the lengths of all the ordinates have been conveyed to the similarly numbered lines, and these last marks will represent the centers of the rivet holes in the girt seam, space off the straight seams for five holes, and after allowing one-half inch all around outside for lap, the sheet is ready to shear and punch.

After rolling, it will be necessary to flange the front and back to suit the angle just from the holes out, and the courses will fit together all O. K.

Some men in making elbows leave one end of each section blank, so after rolling and flanging they require to be fitted together and marked off. This necessitates a great deal of extra work and is uncalled for, as you will notice all the holes are laid out in the elbow just shown. The size of the elbow and the thickness of the material is immaterial, if it is laid out correctly as shown, the holes and fit will be satisfactory. Also, in transferring the lengths of the ordinates the use of dividers for that purpose is not compulsory, as the lengths can be marked on a stick or strip of iron, only be careful to not get them mixed.

*Foreman Boiler-maker, C. M. & St. P. Ry., Dubuque, Iowa.

The Westinghouse Air-Brake Co. have reprinted, with complete drawings, the able paper reported to the Institution of Mechanical Engineers, of England, in 1878, by Capt. Douglas Galton, on "The Effect of Brakes Upon Railway Trains." These experiments were made with apparatus constructed by Geo. Westinghouse, and the results obtained have never been doubted or improved upon.

The Cleveland Twist Drill Company have just shipped three of each size of their grip sockets to the Norfolk Navy Yard. This is the third navy yard that has been equipped with the grip sockets which the Cleveland Twist Drill Company have lately introduced to the market. Many of the largest manufacturers throughout the country have adopted them.

Encouraging Engineers and Firemen to Practice Economy in Engine Supplies.

Superintendent of Motive Power Haskell of the Chicago & West Michigan, and his efficient traveling engineer, C. B Conger, are going about the subject of engine economy in the right way—interesting the men.

They have encouraged the engineers and firemen to try to improve the service without fixing arbitrary limits, and results are following

Just as quick as the men who run and fire engines get interested in seeing how well they can do their work and take a personal interest in the little economies, the saving amounts to something—far more than is usually imagined.

On the first of last March Mr Haskell issued a neat little folder on manilla cardboard, suitable for the vest pocket, and gave it out to the men, it shows what results are obtained by a little oil economy, and is so brief and plain and interesting that we reproduce it complete below

CHICAGO & WEST MICHIGAN R'Y,
DETROIT, LANSING & NORTHERN R R
And Leased Lines.

COST OF LUBRICATING AN ENGINE

making from 20 to 50 miles per pint of Engine Oil, and from 55 to 205 miles per pint of Valve Oil

FOR THE CONSIDERATION OF ENGINEERS AND FIREMEN

Put this in your Vest Pocket for Reference

Grand Rapids, March 1, 1894

MILEAGE IN USE OF OILS

Engine Oil: Miles per pint	Engine Oil: Cost per 100 miles	Valve Oil: Miles per pint	Valve Oil: Cost per 100 miles
20	15.7 cts.	55	11.3 cts.
21	17.8 "	60	10.4 "
22	17.0 "	65	9.6 "
23	16.3 "	70	8.9 "
24	15.6 "	75	8.3 "
25	15.0 "	80	7.8 "
26	14.4 "	85	7.3 "
27	13.8 "	90	6.9 "
28	13.3 "	95	6.5 "
29	12.9 "	100	6.2 "
30	12.5 "	105	5.9 "
31	12.0 "	110	5.6 "
32	11.7 "	115	5.4 "
33	11.3 "	120	5.2 "
34	11.0 "	125	5.0 "
35	10.7 "	130	4.8 "
36	10.4 "	135	4.6 "
37	10.1 "	140	4.4 "
38	9.8 "	145	4.3 "
39	9.6 "	150	4.1 "
40	9.3 "	155	4.0 "
41	9.1 "	160	3.9 "
42	8.9 "	165	3.7 "
43	8.7 "	170	3.6 "
44	8.5 "	175	3.5 "
45	8.3 "	180	3.4 "
46	8.1 "	185	3.3 "
47	7.9 "	190	3.2 "
48	7.7 "	195	3.2 "
49	7.6 "	200	3.1 "
50	7.5 "	205	3.0 "

NOTE Points on Engine Oil

An increase from 20 to 40 miles per pint of Engine Oil means a saving of 94 cents per 1,000 miles If 4,000 miles per month is made it means a saving of $3 76 per month, and for twelve months at same rate, $45 12 for one engine Ten engines, as per above, would save in one year, $451.20.

NOTE. Points on Valve Oil

An increase from 55 to 100 miles per pint of Valve Oil means a saving of 51 cents per 1,000 miles. If 4,000 miles per month is made, it means a saving of $2 04 per month, and for twelve months $24 48 for one engine. For ten engines it would amount to $244 80

Thus ten engines making an increase from 20 to 40 miles per pint of Engine Oil and from 55 to 100 miles per pint of Valve Oil, would save about $696 00. This amount would pay for 29 barrels Engine Oil and 9½ barrels of Valve Oil. These points are worthy of your consideration. A good Engineer is an economical one

B. HASKELL,
Supt M P

This was so useful, and pointed out so plainly the results to be obtained, that a similar one on the subject of fuel was issued on May 1st This is also reproduced below

CHICAGO & WEST MICHIGAN R'Y,
DETROIT, LANSING & NORTHERN R R
And Leased Lines

FOR ENGINEERS AND FIREMEN

COST PER 100 MILES FOR COAL on Locomotives making from 15 to 60 miles per ton of Coal

Fuel is the most *expensive* item in the operation of *Locomotive* The aim of all connected with their operation should be to *reduce* this *cost*

Grand Rapids, May 1, 1894

COST OF COAL PER ENGINE MILE.

Miles per Ton	Cost per 100 Miles.	Miles per Ton	Cost per 100 Miles.
15	$14 66	38	$5.78
16	13.75	39	5.64
17	12.83	40	5.50
18	12.44	41	5.36
19	11.57	42	5.23
20	11.00	43	5.11
21	10.47	44	5.00
22	10.00	45	4.88
23	9.56	46	4.78
24	9.16	47	4.68
25	8.80	48	4.58
26	8.46	49	4.49
27	8.14	50	4.40
28	7.85	51	4.31
29	7.58	52	4.23
30	7.33	53	4.15
31	7.09	54	4.07
32	6.87	55	4.00
33	6.66	56	3.91
34	6.47	57	3.86
35	6.28	58	3.79
36	6.11	59	3.72
37	5.94	60	3.66

NOTE Points on Coal

An increase of one mile from 15 to 16 miles per ton means a saving of 91 cents per 100 miles. An increase of 10 miles per ton from 15 to 25 miles means a saving of $5 86 per 100 miles Enough to more than pay the wages of the engineer and fireman

An increase of only 5 miles per ton from 25 to 30 miles saves $1 47 per 100 miles. This amount for 4,000 miles per month means a saving of $58 80 on only one engine

To save coal requires skill and attention on the part of both engineer and fireman If they work together with this aim, it will effect a saving on a good many engines on this system.

Keep close watch that tenders are not loaded so full that coal is lost off, that the fire is kept even, that flues are kept cleaned out, that arches are clean on top so the fire can get to all the heating surface, that your boiler is supplied with water as steadily as possible To make a good record should be the aim of all the men I am satisfied most of you have that mark now set Try to reach it

B HASKELL,
Supt M P

Mr. Haskell has under his care 123 locomotives, and it's easy for a thoughtful man to see how much could be saved by an extra mile of service to a ton of coal or a pint of oil When the total amount for the road for a year is figured up, the amount is interesting.

That the engineers and firemen are doing their share in the matter is proven by the May performance sheets, which shows that they are making 139 81 miles to a pint of valve oil 32 03 miles to a pint of engine oil, and 35 45 miles per ton of coal, this on a total mileage of 176,021 miles.

Specimen of Welding Cast Steel.

The photographic reproduction shown herewith will give a good idea of a specimen of welding now in this office, It was made by W W. McLelland, foreman blacksmith of the D. & R G. road at Denver, Col In writing on the subject, Mr. McLelland says

"I am not one who believes that you can burn steel and then by some 'hocus-pocus' process restore it to its original state I am opposed to burning steel, even as an experiment. But I send you a specimen of welded cast steel that will, I think, show quite clearly that a high tempered steel can 'with a suitable flux' be safely heated so that you can weld it easily and as solidly as the specimen I send you, without injury to the steel. Our flux is home-made and contains no borax. Show the specimen to any of your blacksmith friends who may call at your office, perhaps they may send you something better.

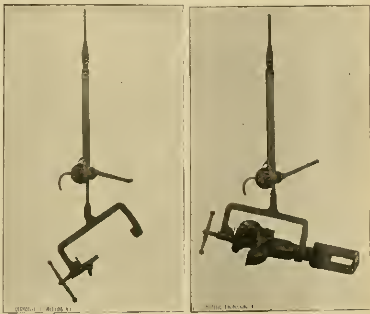
"I have been experimenting for eighteen months, am almost temoted to think I have something that may be valuable."

SPECIMEN OF WELDING CAST STEEL.

The specimen was made of five old taps and lathe tools welded together, and the bar formed of them, when polished, shows no sign of the welds and appears a solid bar.

Device for Holding Couplers While Riveting on Yokes.

Among the many other ingenious shop tools to be found in the shops of the Western New York & Pennsylvania, of which



DEVICE FOR HOLDING DRAWBAR WHILE YOKE IS BEING RIVETED ON.

Mr. Allen Vail is superintendent of motive power, can be seen the above handy device

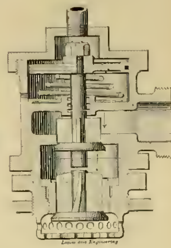
The cuts show so plainly just how it is constructed that other description seems unnecessary.

The yoke simply hooks under the round part or stem of the drawbar, and the other end has a lip that enters the link-slot in the knuckle, and is held there by a pin through the lip and pin hole of the knuckle, this lip has a shaft on one end which turns in a box on the back end of the yoke and has a handle on it, with this handle the coupler can be turned over as wanted. The yoke is hung near the center to a support from a trolley track above. Means of raising, lowering and holding are provided by the crank, pawls and ratchet wheels.

One helper can pick up a coupler and carry it to anvil or steam hammer, hold and turn it while tail yoke is being riveted and deliver it at the other side of shop very easily and expeditiously.

McIntosh's Improved Blow-off Cock.

The engraving shown herewith represents the form of blow-off valve used on that part of the Northwestern road, where



the motive power is in charge of Mr Wm McIntosh, at Winona, Minn

This valve is handled from the cab by compressed air, and is doing good service on the road.

As will be seen, there are two valves between the water in the boiler and the atmosphere, one of them acts as a safety check in case the valve is broken off.

The spring shown insures the closing of the second valve upon the release of the pressure from over the piston, the inner valve is closed by the boiler pressure alone This valve has twisted wings, or vanes, that causes it to revolve when moving, thus seating in a new place. A strainer is used as shown.

There is no packing used about the cock, and it is opened and closed by use of a small valve in the cab. Another hard and dirty job neatly done by compressed air

The practice of putting out a blue flag at a station to indicate that a car-repairer is at work on the train was first introduced by Mr. H. C. Stone, when he was general superintendent of the C., B. & Q. The practice was found to be so much in the practice of safety that other companies soon adopted it, and the blue flag is now a recognized workman's signal.

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The Pullman Strike and Boycott.

[illegible] June issue, after congratulating the American Railway Union and the [illegible] Northern Railroad employés on the [illegible] of the strike on that road, which [illegible] considered a victory over an attempted [illegible] we added: "If the officers and [illegible] of this new order only keep cool, [illegible] swelled heads, ask only for what is [illegible] and demand only justice—justice for [illegible] as well as their own—they will [illegible] to elevate and help their own [illegible] and railroad workmen every- [illegible] the respect of the [illegible] the country. That [illegible] strength in a union of all classes [illegible] men has been proven. Let us [illegible], that there will be no excesses [illegible] side that will call for another [illegible] prove it over again."

[illegible] words which conveyed sound ad- [illegible] warning of danger had been cir- [illegible] only three weeks when the Ameri- [illegible] Union engaged in one of the [illegible] strikes the world has ever [illegible]. The cause of the strike was not on [illegible] of the wrongs or grievances en- [illegible] by the employés of any railroad com- [illegible] but because a manufacturing con- [illegible] cut the wages of its workmen to [illegible] point. We believe that every [illegible] directly and indirectly concerned in the strike and boycott against Pullman cars will now regret that our salutary and conservative advice was not followed.

While we warmly sympathize with the oppression endured by the workmen at Pullman, we do not consider that the righting of their wrongs was the business of any railroad labor organization, and looked upon from a business standpoint it was a false move. An unsuccessful strike is a terrible disaster to those who engage in it. Strikes are sometimes successful when waged against individuals and corporations, but they are never victorious when directed against the American people or even against the sympathies of the people. There is a strong liking for fair play among the masses of our people, and when they learn that workmen have struck against tangible wrongs, their sympathies are aroused, and strong moral support is given to those who are supposed to be standing out against injustice. The moral support of a community has tremendous sustaining power, and is almost a certain augury of success. This same spirit of fair play holds the people opposed to sympathetic strikes and boycotts. As a nation they have been trained to mind their own business and to avoid taking a hand in foreign quarrels. The action of railroad men refusing to work because the employés of a manufacturing concern were underpaid seems to the average American on a par with going to war with Spain because of injustice inflicted upon the residents of Cuba. Sympathetic strikes are regarded as senseless, but boycotts in all their forms are hated by Americans as the blindest kind of tyranny. The people are too intelligent not to realize that a boycott hits twenty innocent persons to one against whom a grievance is entertained. The paralysis of railroad business caused by the strikes brought suffering to thousands of persons in no way connected with railroads, and many more thousands of innocent persons had to pay for increased cost of food. These things come directly home and are likely to be an object lesson against sympathetic strikes and boycotts that will not soon be forgotten.

Pullman's Cheapening of Cars.

Since the railroad strikes happened there have been numerous attempts made to defend the action of the Pullman Company in reducing the wages of car builders, on the grounds that the prices paid for car building is so low that the work could not be done unless the price of labor was exceptionally low. We should like to ask these apologizers for and defenders of the Pullman Company, who was responsible for bringing the building of cars to a point of cheapness where living wages could not be paid? Every one who understands how car-building contracts have been awarded in the last year is perfectly aware that Pullman has been principally responsible for the unparalleled low prices for which contracts have been taken. Pullman has grasped nearly all the orders given out because he had a wage-reducing hold upon his workmen possessed by no other manufacturer of cars. When bids were put in for building a lot of cars, the ordinary run of builders would figure on living wages for their workmen reduced as far as reason would go, and they would generally offer to take the contract on cost prices. These figures were nearly always underbid by the Pullman Company, because the latter were aware that their workmen housed in dwellings rented from the company and held in bondage by the institutions peculiar to that extraordinary social vampire, could not successfully resist reduction in wages of a character which no other car builders would ask their men to submit to. This is not fair competition. It is forcing other car builders and their workmen to the wall by a power which no company or individual has a right to exercise in a free country.

We should like to know who or what has derived benefit from this unequaled era of cheapness in car building brought about by the Pullman methods. Railroad companies may save a few dollars in a car, but it is not felt in their aggregate expenditures. The workman has no money to spend beyond paying for bare living, and all those who benefit from the active circulation of money suffer in consequence. It is a sorrowful outlook for a country when the law of free competition is exceeded to bring prices down to the bare necessities of life. Cheapness is a curse to every country where it holds dominion.

Steel to Strengthen Cars.

The low price of steel ought to lead to a more liberal use of this strong material in car construction, remarked one of our ablest superintendents of machinery the other day, but this is a desirable change which makes progress slowly. The movement in this direction is increasing, but we must all be careful not to fall into serious mistakes. The most judicious policy is to use steel in strengthening the weak parts and applying that metal to individual members of the car. The Lehigh Valley people have done a very courageous thing in putting Fox steel trucks under a thousand cars. That act is going to have great influence in leading to agreement about a standard truck. All body bolsters ought to be made of steel, a move that might also be worked in the interests of uniformity.

There were some remarkably good points made by Mr. J. D. McIlwain in his paper on Steel in Car Construction, especially that part where he treated on the weak construction of passenger cars. There is no doubt that the ends of passenger cars is a weak element in their construction and the judicious use of steel in construction might do much to end the disastrous collapsing that is common when severe collisions happen. The Lake Shore people and the Michigan Central car department have adopted a composite form of construction for the ends of passenger cars that is calculated to overcome the weakness of these parts, but the great mass of railroad companies cling to the old cheap methods that prove so expensive when an accident happens. The vestibule undoubtedly does good service in reducing the destructive effects of collisions, and arrangements like the Leonard buffer are very valuable aids in reducing the destructive effects of violent shocks; but these improvements are seldom found in ordinary day cars which constitute the great bulk of passenger equipment. These need to be improved.

It would be a particularly radical change to abolish the car platform, but we do not see any reason why it should be retained. Its original purpose was to make a convenient stand for the brakeman, but it has always been a dangerous and weak element. By leaving off the platform continuous sills could be used, and the draft rigging secured in a substantial manner between the center sills. If these were made of steel I-beams, the chances of disaster in case of accident would be greatly reduced. This is an improvement that could readily be introduced on ordinary day cars. The pressing need is that the men in charge of rolling stock should educate themselves to the advantage of the change.

Aiding Quick Transfer of Cars.

If the railroad officials belonging to all the lines running into points where a great deal of interchange of cars takes place could agree to work together, as the railroad officers in Cincinnati are doing, we believe that the harassing annoyances now experienced in the interchange of cars would be greatly reduced. The Cincinnati Association of Railroad Officers is composed of representatives from eight railroads with termini in that city, and the object of the organization is to keep a general supervision over matters relating to the interchange of cars. This is unlike some similar organizations, in the fact that the Master Car Builders' rules of interchange of cars are strictly followed in car movements. Modifications are sometimes made to prevent delays, but the business in a general way is regulated by the rules in question. The work is done under the supervision of a standing committee elected by the association. This standing committee appoints a joint inspector, who has immediate charge of the work, and he appoints the necessary sub-inspectors required for the business. He has complete control over the sub-inspectors, and is responsible for their work being done properly, and he in his turn is accountable to the standing committee for the whole business being conducted satisfactorily.

A decided benefit which the railroad companies derive from the arrangement is, that disputes are reduced to a minimum, the various inspectors having no means of causing delays while settling grudges against each other.

Among the special rules prepared for facilitating the movement of cars are the following:

In case a car which is in need of repairs should be overlooked by the interchange inspector, and car delivered, said car may be repaired by the receiving road on an order from the joint inspector, said order to accompany bill against road delivering the car. The transfer or switching road, in such cases, shall not be considered the delivering road, so far as repairs are concerned, except where defects plainly indicate the result of accident or casualty while in their possession.

In case a loaded car is delivered which is in need of repairs that render transfer necessary, in order that repairs can be made the joint inspector will give the receiving road an order to transfer and charge same to road making delivery.

The joint inspector will not give an order for transfer of any car where repairs can be made inside of twenty-four hours without transfer.

Abolish the Wire Gauge.

Considering the activity which has been displayed by all engineering interests in this country for years, towards uniformity of measurements, we have often been surprised to witness the great confusion that continues to exist in the measurements that are known as wire gauges. The number of a wire gauge does not represent the same measure in different shops, or in different parts of the country. There are Birmingham Stubb's and the United States Standard Wire Gauge, all differing in size from each other. The inconvenience that results from this condition of affairs has been very annoying, and at times very expensive. It is surprising that those having to order goods, whose dimensions are specified according to wire gauges, have endured the inconvenience so long. We are glad to see that a movement is on foot to effect a reform in this regard. The American Society of Mechanical Engineers have had a committee working on the reform for several years, and now, at the instance of Mr. Geo. R. Henderson, it has been taken up by the American Railway Master Mechanics' Association, and a committee appointed to submit at the next annual convention, a method for ordering material by the decimal system for adoption and general use of the members of the association. In moving for a committee to take up this subject, Mr. Henderson made a very strong plea for reform, showing a decided preference for the decimal value for measurement of sheet metal and wire, the use of the micrometer or its equivalent being strongly recommended.

The Brown & Sharp micrometer gauge has been a standard of the Master Mechanics' Association for twelve years, and the members are presumably familiar with its advantages in making fine measurements. The men whose duty it is to order goods for railroad companies, are by this time sufficiently familiar with the micrometer gauge, to experience no difficulty in using it.

We Are Advertised by Our Loving (?) Friends.

Of course all the outrages committed in the neighborhood of Chicago within the last four weeks will be laid to the strikers—little account will be taken of the acts of the scum of God's creation gathered there.

Some of this "scum" thought of a new scheme to advertise LOCOMOTIVE ENGINEERING, and to that end sent out an anonymous slip containing *part* of an editorial of ours on the Great Northern strike.

They sent it only to general officers, and were careful to state that one of the editors of the paper was secretary of the Master Mechanics' Association and the other secretary of the New York Railroad Club.

The last clause of that editorial reads as follows:

"*If the officers and members of this new order only keep cool, avoid swelled heads, ask for only what is right and demand only justice—justice for the other side as well as their own—they will do much to elevate and help their* *own members, and railroad workmen everywhere, and still hold the respect of the railroad officers of the country. That there is strength in a union of all classes of railroad men has been proven. Let us hope, then, there will be no excesses on either side that will call for another clash to prove it over again."*

That piece of advice would have defeated the purpose for which the ship was sent out—to hurt the reputation of the paper with railroad officials. The strikers did not do that.

This paper has always been a mechanical one, it has an aim, and that is to "increase the efficiency of the motive power and rolling stock of American railroads." We believe the best way to do this is to make *better mechanics and engineers* out of our readers.

We have never carried water on both shoulders, and we won't. We have often condemned abuses on both sides of the labor question, and have always given the best advice we knew how.

In the Great Northern strike we believed the men were right—and said so. In the great sympathetic strike and boycott we think they are wrong—and say so.

There never has been any doubt as to where we would be found—on the side of justice and right as we saw it.

We have and do try to avoid all subjects except mechanical and engineering ones—but we cannot ignore the pages of history being made around us daily.

We do object to half truths—they are ten times as dangerous as full-fledged lies—and that's why we are making this kick.

That ship was sent out by a business rival, and it will be a boomerang, for it is a well-known axiom that "To mention a rival is to advertise him, to slander him is to degrade yourself."

We had a notion that writing this would relieve us and make us feel better, but it don't—what good does it do a grown man to step on a pismire?

The members of the Association of Railroad Air-Brake Men should be proud of their first annual report. It is gotten up in a way that other associations can well afford to imitate. The editors of LOCOMOTIVE ENGINEERING cannot indorse too strongly such associations of railroad men as this one. They meet with one object in view—self education—but this object means much to the railroads and the public. Our railroads have become of as much importance and their service is as much depended on as the mail service or any other function of the government. Railroading is made up of many details, any one of which is as important to the public as are streets or highways—they are part of our necessities. The air-brake is the most important of railroad detail, and a knowledge of it is as much a trade as any mechanical pursuit can be. It is comparatively a new business—the maintenance of air-brakes—and the men who form this association have no West Point or Annapolis to graduate from, they must instruct themselves, and this they are doing in the best way possible—by an exchange of ideas and experience. Every encouragement possible should be extended to this association and the sister one, the Traveling Engineers. Their meetings are only fraught with good to themselves, their employers, and the public.

We do not know of any railroad company in the country that has been carrying on improvements that are likely to be of so much permanent value as those carried out within the last three years by the Lake Shore & Michigan Southern. There has been very little public mention of the work done, and we were surprised during a recent trip over the road to find so many improvements on the road-bed and track. All the grades have been cut down to a maximum of about sixteen feet to the mile, and very heavy work has been done in straightening out curves. It has been, in a great measure, owing to these improvements that the Lake Shore people are able to run their exceptionally heavy passenger trains with unusually light locomotives. President Newall, it is well known, is a strong advocate of first-class track and track equipment, and he does not favor the use of heavy locomotives that are calculated to hammer the track to pieces prematurely. From what we have seen of the trains operating on this road, we believe that President Newall's policy is likely to result in decided and permanent reduction of operating expenses.

It is sad to reflect that railroads with an air of romance about them are subject to the same influences which brought the Prairie Midland and the Mountain Central to grief. About two years ago we gave illustrations of locomotives from the Baldwin Locomotive Works being unloaded at Jaffa for the Jaffa & Jerusalem Railway. The engines were duly put in service and the road opened. The population of Jerusalem has greatly increased of late years, and is now about 90,000. It was expected that the railway would greatly boom the ancient city, and that the adjacent territory would begin to have fewer beggars and more laborers. These improvements may be on the way, but they did not come soon enough to give the railway a paying business. The tourists who were to crowd the trains did not appear in the expected numbers, and the consequence is that the company has defaulted in the interest of its bonds, and the road is in the hands of its enemy—a receiver, or his Asia Minor equivalent.

The courts are evidently according great credence to the conclusions of the Patent Office, and giving more consideration to the right of inventors. Six important suits, decided within a few months in United States courts in various parts of the country, awarded damages for infringement, and sustain patents for air-brakes, for the incandescent lamp, for locomotive brake shoes, for water filters, for hay bands, for certain systems of car-heating. The more careful system of examining patent applications at Washington in the first instance, seems to be bearing good fruit in making such patents as are drawn by competent attorneys and finally issued, of actual value.

The Society of Locomotive and Carriage Superintendents of India have adopted a very compact way of showing the leading particulars of locomotives. It looks like an algebraic formula, thus $W^{18}_{8\ 48}$. That means W—class of engine, 18—diameter of cylinders, 8—number of coupled wheels, 48—diameter of drivers in inches.

BOOK REVIEW.

AMERICAN STREET RAILWAY INVESTMENTS. Published annually for the use of Bankers, Brokers, Capitalists, Investors and Street Railway Companies. The Street Railway Publishing Co., 26 Cortlandt Street, New York. 216 pages, including 24 maps. Cloth. Price, $5.00.

This is a large work, giving a great deal of information to those interested in street railroad securities, etc. It gives a brief description and some statistics of every city having street roads, tells the mileage, power, etc., and gives a list of the stocks and bonds, indebtedness, etc. We should think it would be invaluable to street railroad officers and investors.

While the Rules of Interchange of Cars were under discussion at the M. C. B. Convention, Mr. R. H. Soule, of the Norfolk & Western, proposed the highly desirable amendment that handholds and steps for cars be made only of wrought iron or steel. It is an outrage that these parts, on which a human life often hangs, should in many cases be made of the poorest kind of cast-iron. Mr. C. A. Schroyer, of the Chicago & Northwestern, raised the curious objection that his car inspectors could not tell the difference between steel and cast iron.

PERSONAL.

Mr. R. T. Rundlett has been appointed general manager of the Wiscasset & Quebec Railway, with headquarters at Wiscasset, Me.

Mr. G. Gunby Jordan, general manager of the Georgia Midland & Gulf Railroad, has been appointed State Railroad Commissioner of Georgia.

Mr. Frank D. Jones, heretofore chief engineer, has been appointed superintendent of the Glendon & Gulf railroad, with headquarters at Glendon, N. C.

Mr. Jacob Martin recently died at Charleston, S. C. He had run a locomotive for over fifty years on the S. C. R. R., the last forty-five without an accident.

Mr. Wm. T. Harding, late of the Baldwin Locomotive Works, has been appointed chief draughtsman for the Seaboard Air Line, with office at Raleigh, N. C.

Mr. L. M. Martin has been appointed general manager of the Iowa Central, with headquarters at Marshalltown, Ia. He was formerly with the Des Moines & Western.

Mr. Jas. Maglenn, heretofore master mechanic, has been appointed general superintendent of motive power of the Seaboard Air Line, with headquarters at Raleigh, N. C.

Mr. B. S. Shaw, master mechanic of the Georgia, Carolina & Northern Ry., has been promoted to the office of master of machinery of the Seaboard Air Line, at Raleigh, N. C.

Mr. James A. Eagan has been appointed general foreman of locomotive repairs of the Santiago shops of the Mexican National Ry., City of Mexico. He was formerly roundhouse foreman.

John W. Dickinson has been appointed division superintendent of the Southern Division of the Gulf, Colorado & Santa Fé Ry. Co., with headquarters at Temple, Tex., *vice* C. S. Hayden, resigned.

Mr. H. E. Folsom, superintendent of the Passumpsic division of the Boston & Maine, has also been appointed superintendent of the Connecticut River division of that road, in place of Mr. H. E. Howard. His headquarters remain at Lyndonville, Vt.

Mr. George Preston, master mechanic of the Canadian Pacific shops, at Toronto Junction, has been appointed master mechanic of the lines east of Montreal, with headquarters at Farnham, Que., in place of Mr. George MacKinnon, who succeeds Mr. Preston as master mechanic at Toronto Junction.

Mr. David Ramsdell, foreman pattern-maker, for the Iowa Central, at Marshalltown, Ia., dropped dead on the streets of Chicago last month. Mr. Ramsdell has been engaged on railroad work for many years and was long pattern maker of the Burlington, Cedar Rapids & Northern, at Cedar Rapids, Ia.

Mr. Henry F. Sampson has been appointed assistant superintendent of the Connecticut River and Passumpsic divisions of the Boston & Maine, with headquarters at Springfield, Mass. Mr. Sampson was superintendent of the Connecticut River road before it was leased by the Boston & Maine in April, 1893.

Mr. W. S. Jones has been appointed general superintendent of the South Carolina & Georgia Railroad, with headquarters at Charleston, S. C. He was formerly a division superintendent of the Long Island Railroad, and has been closely associated with President Barton of the South Carolina & Georgia road.

Mr. Stanford T. Crapo has been appointed acting general manager of the Flint & Père Marquette Railroad in place of Mr. W. H. Baldwin. Mr. Crapo is a young man, only twenty-nine years old, but has worked his way upward in ten years to be assistant general manager. He is a son of the president of the road.

Mr. A. M. McCracken, heretofore superintendent, has been appointed general superintendent of the Louisville, St. Louis & Texas, with full charge, under the receiver, of all departments of the company's business, and all duties heretofore performed by the general manager and superintendent will be performed by him. Headquarters, Louisville, Ky.

Mr. A. L. Mohler has been appointed general manager of the Minneapolis & St. Louis, with headquarters at Minneapolis, Minn. Mr. Mohler was for several years general manager of the Great Northern, and before that held the same position on the St. Paul & Duluth. He is a pleasant gentleman and an excellent railroad man, and his appointment will give much satisfaction to hosts of friends in the Northwest.

Some important improvements have lately been made by Mr. William C. Baker on his well-known car-heater, which promise to make it even more popular than it is. It was necessary for Mr. Baker to leave the Master Car Builders' Convention before the meeting ended in order to supervise some of the changes being made on the heater. He reports business to be remarkably good, considering the prevailing depression on railroads.

Mr. J. E. Hogan, foreman boiler-maker on the A. T. & S. F. at La Junta, Colorado, has a record board for keeping track of his boiler washing, which is an item of importance in bad water. This board is laid off in squares, the lines one way being numbered from 1 to 31 to represent the days of the month, on the lines the other way, are the numbers of the engines running into La Junta. When an engine is thoroughly washed out an X is placed in her line in the square under the proper date, if only the water is changed they mark the square O. This saves lots of work, takes only a few seconds to record the day's work, and shows just what engines need washing as well as those washed.

Those who met Mr. J. N. Lauder, superintendent of motive power of the Old Colony divisions of the New York, New Haven & Hartford, at the last Master Mechanics' Convention and noted how ill he looked will not be surprised to learn that he has been prostrated with a most severe illness, and is lying very low at his home at Concord. Mr. Lauder is one of our best known master mechanics, and few men hold such positive views on everything relating to railroad matters. Although a man of strong convictions, Mr. Lauder seldom gives offence in the expression of his opinions, and few men in the country have such a large circle of warm friends. We earnestly hope that his great will-power and iron constitution will pull Mr. Lauder safely out of the affliction he is now enduring.

To the casual observer there were no persons attending the last Master Mechanics' Convention, who enjoyed themselves more than William T. Small, and no person in the company had a more cheerful demeanor. The courage and sustaining fortitude of the man may be appreciated, when it is known that the cloud of a fatal disease was upon him, which closed his life two weeks after he returned from Saratoga. Mr. Small underwent an operation a year ago for appendicitis, and it led to complications which proved fatal. He was one of our best known master mechanics, having been in various prominent positions, that of superintendent of motive power of the Northern Pacific, making him best known. At the time of his death he was superintendent of motive power of the Buffalo, Rochester & Pittsburgh.

On the 21st of July Angus Sinclair sailed away for France on *La Touraine*. Angus will visit his old mother up among the Highland heather of bonnie Scotland, and then hunt something worth writing about on the Continent. He has several pressing invitations to visit some motive power officials in Russia, who were here to the Fair last year, but the cholera may keep him away from St. Petersburg and Moscow. It is really comical to notice with what care some men, who swear they never are seasick, will hunt up all the patent remedies for that disease and smuggle them into their baggage "unbeknownst" to their friends. The J. P. sincerely hopes that the Senior Philosopher will have a good time and come back refreshed, ready and willing, as he has always been, to take the big end of the load, while his partner does the grunting.

He Held the Fort.

"Do you know that little fellow?" asked an old-timer, as the scribe shook hands with Gus Dowdell, of the Gould Coupler Co., on the porch at Saratoga.

"Yes, he's with Gould—"

"Oh, I know, I know, my boy, but do you know his history?"

The scribe took out his note book and put down a mark—it was one of the few things left that he had not found out—and answered "No."

"Well, sir, that boy was a telegraph operator on the Pennsylvania road at Pittsburgh during the Centennial, and the great strike of '77 found him there. He stayed at his post to the last. When the old Union depot was ablaze, he wired 'The depot is on fire now,' and half an hour later: 'This room is too hot to stay in any longer, good bye.' Then he took the screws out of his key, tore it off the table, put it under his coat and left.

When old Tom Scott heard of it, he sent for the boy, and gave him a good job, took him to Europe with him the next year and the year following sent him over alone, besides he gave him a pass for life on the P. R. R. system. Gus is a brick, you bet!"

Small but Firm.

It was in the smoking car on the New York Central. There was one chap who was blustering a great deal and telling how many duels he had fought, and behind him, sat a small man reading a magazine.

"Sir!" said the big man, as he wheeled around, "what would you do if challenged?"

"Refuse," was the quiet reply.

"Ah! I thought as much. Refuse and be branded as a coward! What if a gentleman offered you the choice of a duel or a public horse-whipping—then what?"

"I'd take the whipping."

"Ah! I thought so, thought so from the looks of you. Suppose, sir, you had foully slandered me?"

"I never slander."

"Then, sir, suppose I had coolly and deliberately insulted you. What would you do?"

"I'd rise up this way, put down my book this way, and reach over like this, and take you by the nose like this, and give it a three-quarter twist—just so!"

When the little man let go of the big man's nose, the man with the white hat on began to crouch down to get away from bullets, but there was no shooting. The big man turned red, then pale, then looked the little man over and remarked:

"Certainly—of course—that's it exactly!"

The little man, whose name is Twombly, had resumed reading his magazine. When the others found that the case was settled they returned to their talk about the strikes.

EQUIPMENT NOTES.

Murray, Dougal & Co. have orders for 400 freight cars for the N. Y., S. & W.

The Rogers Locomotive Co. are building eight freight locomotives for the N. Y., S. & W. R. R.

The Southern Pacific have under advisement the ordering of some 35 locomotives. 15 of them will probably be let soon.

The Jackson & Woodin Mfg. Co. have orders for 150 hopper-bottom coal cars and six stock cars for the Delaware & Hudson; they will have Westinghouse air-brakes, M. C. B. couplers and standards.

The Lehigh Valley order for 2,000 coal cars was divided between the Buffalo Car Mfg. Co. and the Lebanon Mfg. Co., 1,000 each. The cars will have Westinghouse brakes, Fox pressed steel trucks and the King hopper doors.

The Schenectady Works are building two heavy 8-wheeled passenger locomotives for the Boston & Albany; they will be used on the heavy grade between Springfield and Albany. They are also rebuilding two engines for the same company.

The Juniata shops of the P. R. R. have just turned out three of the sixteen new class "P" eight-wheelers recently ordered. They have 19x24-inch cylinders, 80-inch wheels, a 57-inch boiler (Belpaire), carrying 175 pounds of steam. They weigh 125,000 pounds.

The Schenectady Locomotive Works have an order for twenty locomotives for the Maine Central. Twelve will be mogul freight engines, five 8-wheel passenger engines, and three will be 6-wheel switchers. The road engines will all have Westinghouse air-brakes.

Rapid Evaporation in Locomotive Boilers.

Considering the tremendous rapidity with which locomotive boilers convert water into steam, it is surprising that the accident of burned crown-sheets is so exceedingly rare. We know of nothing which forms a better testimony to the care and vigilance of the average locomotive engineer. Everybody who has had experience in the cab of a locomotive is well aware how rapidly the water disappears if anything happens to prevent the injectors working, but very few people have seen actual figures of the tremendous evaporation going on. Mr. Sanderson, of the Norfolk & Western, speaking on this subject some time ago, gives figures that will be interesting to most of our readers. He said: "Several years ago, when they had some engines burned owing to the carelessness of enginemen, they made experiments with one of their engines, which has a boiler 60 inches in diameter, has 1,774 square feet of heating surface, and 11 square feet of grate area. The quantity of water evaporated when one safety-valve was blowing off was twelve gallons per minute; when both safety-valves were blowing off the rate is doubled. When the engine is working moderately, the feed water is used up at the rate of about forty-four gallons per minute. When the engine was working hard on a hill, the evaporation rose to seventy-seven gallons of water per minute. The last figures represent measurements taken when the safety-valves are closed, so that if the engine is working hard on a hill, and both safety-valves blowing off, the water would be going away at the rate of eighty-nine gallons per minute. This represents nearly 1 inch in the water gauge per minute, so it can readily be seen how little time there is for a crown-sheet to get exposed when anything has happened to stop the feed-water supply.

An Irascible Traveler.

BY E. L. MEEHAN.

He was a little, old, dried-up Yankee from Maine; the top of his bald head glistened in the light like the top of a newly varnished sandbox dome, while two faded little watery eyes peered through an antiquated pair of gold-rimmed spectacles.

His legs defied description; though to an unprejudiced person, these members would certainly not look more homely than bent side rods, and barring a distinct wabble in his gait, which suggested a section of shafting out of line, it must be admitted that his legs performed nobly the duty for which they were appended to his short, thick body, even though he was exceedingly nervous and pettish, the result of rheumatic gout, with which, so he informed me, he suffered continually.

My first meeting with him was in the smoking room of a Mann boudoir car, *en route* from Fort Worth, Texas, and the manner in which I became acquainted with him might be considered novel, when I say that our acquaintance grew out of a volume of sincere, though seemingly reluctant apologies, occasioned by his having made a mistake and dropped a five minutes' accumulation of tobacco "spit" into my traveling cap, which had fallen from my head to the floor while I was taking an afternoon snooze; it is needless to say that his apology was readily accepted, since I knew that those eyes of his could not distinguish between my nobby cap and a cuspidor.

While the train was standing at a station, after dark, he sat fidgeting in his seat, nervously chewing the end of a "Newsboy's delight," and it was only by exercising my keenest powers of smelling that I was able to distinguish between the exhalations of his "onion" and the disagreeable odors occasioned by a hot box in our car; anyway I congratulated myself upon the fact that my nasal organs were above the average, to be able to detect such a difference, if any.

While I sat thus congratulating myself, he suddenly jumped up, calling vociferously for the porter, whom he informed in terms more emphatic than polite, that the railroad company had no respect for the lives of its passengers, and ordered him to pull down all the curtains in the car at once, lest some one should throw rocks through the windows.

After having abused everybody and everything connected with the company, he looked somewhat appeased, and started down the aisle to his berth. On his way down he tripped over a pair of shoes, but said nothing until he came to another pair, sticking out from under the curtains. This vision so irritated him, that he stood still in silent contemplation for a moment, then gave them a mighty kick, calculated to drive them through the door at the end; but, strange to relate, these shoes had feet in them, and it was only by bringing all my powers of persuasion into play, that I prevailed upon the owner of these feet to forego his intention of spoiling the beauty of my erratic friend, who seemed very grateful to me by not uttering a word, but casting at me a look, which, for a moment, lost its usual suggestion of disgust. This, on account of its rarity, spoke more eloquently than words, and just before he stepped upon the face of the man in the lower berth, in his attempt to scramble into his upper berth, he informed me that he would stop over a day at New Orleans with me, in order to be able to travel with me to Fort Worth.

At the St. Charles Hotel a scratching pen annoyed him and excited his ire, while registering. This he promptly threw upon the floor with all the force he could command, and proceeded to deliver his opinion of any first-class hotel that would hand such a pen to a man, with which to register. This opinion was much in the nature of a Frenchman's oration, with the exception that many of the words could not be found in the dictionary. The well-trained clerk did not vouchsafe a reply, but I observed that he took from the desk an old pewter spoon with one end chewed off, and retired to the private office until we were shown to our rooms.

Upon our arrival in Marshall, Texas, we stopped at the first hotel we found, and were assigned to a table in the dining-room that had accommodations for six persons. As we sat down three other guests took seats at the same table. One of these was evidently troubled with "choked nozzles," as his "exhausts" could be heard all over the room, or perhaps, as his appearance would seem to indicate, these "exhausts" were occasioned by the excitement which is generally attendant upon the first visit of a man to a town. The second guest I concluded must surely have been a professional sword-swallower from some dime museum, at least he would not have done discredit to one of that profession, judging from the reckless manner with which he handled his knife while devouring a large dish of cabbage; but, owing to his profession this could hardly be attributed to bad breeding, but rather to the force of habit. I noticed while these operations were in progress, that my Yankee friend was growing even more nervous and irritated than usual, though he held his own counsel until the third guest, after having eaten a yard of fat spare ribs, began to gag and cough. He jumped up and left the table, with the remark that he supposed the next course would be chopped hay and oats; the three guests "shut off" and looked up for a moment, but resumed work without comment, evidently thinking that the remark was not intended for them.

The sleeper from Marshall to Fort Worth was a compartment car, and all the lower berths but one were sold. I happened to know the conductor of the car, and gave him an outline of my experience with my friend. He seemed to be much amused at my recital, and remarked that he had another just such character aboard, and would put my friend in the upper berth over him; giving me the lower in the same compartment.

We accordingly fixed up a little plot to break the monotony of the trip, I telling my friend that the man who was to occupy the berth under him had just been discharged by an asylum, cured, having been a dangerous maniac, and that it would be well to watch him.

The conductor told the other erratic individual that my friend was suffering from periodical insanity, and that I was taking him to Fort Worth to be treated.

My friend sat out in the aisle, on a camp chair, glaring through the little opening at the end of the compartment at the supposed maniac inside, while the other man, who was a little, dried-up individual, with a glass eye and a flat wheel, sat up against the window and glared back at my friend, both conjuring up in their minds terrible scenes of a midnight encounter with a maniac.

While the berths were being made up, I sat in the smoking-room, smoking a cigar with the conductor, and forgot for the time being what must be the feelings of my friend. As I entered the compartment the first thing that caught my eye was the man with the glass eye sitting up in his berth, dressed in a suit of white linen "pajamas," while his head was amply protected by a white linen night-cap with draw-strings to it; thus he sat, disagreeable expectancy written in every line of his wrinkled face, staring like a great owl through an opening in the curtains.

My friend would not allow the porter to turn down the gas, preferring to suffer with the heat and the light shining in his face, rather than run any chance of being attacked unawares. There he was, lying half on his side, with his neck craned over, watching for any suspicious move on the part of his neighbor, and irritation, revenge, anger and fear struggling which should make themselves more prominent his eyes, which looked now to be losing saucers. I do not know how long this lasted, but I do know that I was rudely awakened in the night by a loud crash and springing through the curtains to the floor, beheld a horrible sight. It seems that either through accident or a malicious desire of the porter to retaliate upon his tormentor of the day, the upper berth, that had not been fastened up securely, had been from its mooring from the constant agitation occasioned by the nervous restlessness of its occupant, and had come down with a crash.

There were bent "side rods," "flat spots," spectacles and night caps mixed in a terrible confusion for a few moments, while the two supposed maniacs were clinched in a death grip, each afraid to relax his hold on the other, and both calling vociferously for the porter.

After much trouble and force we got them separated, and neither of them would sleep again for the balance of the night. We got off the car in the morning, at opposite ends, the man with the glass eye walking down the platform with his "flat wheel" catching on the raised planks, and his eye in upside down.

Upon our arrival at the Arlington Inn, my friend discovered that in the excitement of the night he had put on the porter's shoes, and beginning to suspect the truth, bade me a not very affectionate farewell.

Special Shop Tools.

There is so much pressure placed on men in charge of railway machinery at the present day to keep the power and rolling stock in operation at the least possible expense, that every method in use for keeping down this expense is of living interest to all the master mechanics and car builders in the country. On this account the report submitted to the Railway Master Mechanics' Convention on "Special Shop Tools" was of great practical value. There are two features about this admirable report which are especially worthy of notice. One is the great ingenuity displayed in railway shops in the invention and perfecting of special tools for finishing work more expeditiously and accurately; the other is the readiness displayed by men in charge of nearly all railroad shops to take advantage of the devices invented and perfected in other places. There is no class of men having charge of work that search more keenly for information respecting the business than master mechanics and master car builders, and a new invention is rarely perfected long before it is to be found in use all over the country. The illustrated railroad journals give great assistance in disseminating this kind of valuable information, and railroad companies are much more indebted to railroad papers for keeping down expense of repairs than they are aware of or are willing to admit.

Mr. T. W. Gentry, who did the principal work in preparing this report, was exceptionally equipped for the work on hand, as the shops of the Richmond & Danville, at Richmond, which he had charge of for the last eight or ten years, is better provided with special tools than any establishment that we are aware of. The principal work of designing and selecting had been mostly done by Mr. Gentry himself. Having specially interested himself in special shop tools, he naturally came to know what shops were noted for getting out these tools for facilitating work, and he was able to prepare a long list for the information of members. We do not know of anything that can be studied to more advantage by those interested in improving their shop facilities than the five pages in the report referred to, giving names of special appliances in use at various railroad shops.

The Baldwin Locomotive Works have just shipped six locomotives to Japan.

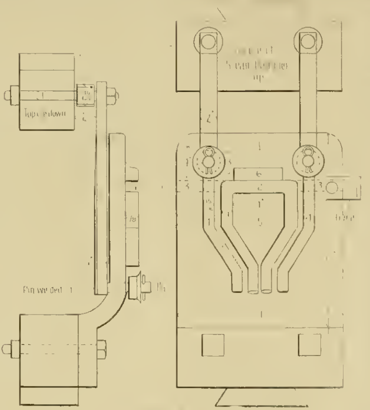
Some Blacksmith Shop Tools that Save Time and Money.

After the first annual meeting of the Foreman Blacksmiths' Association, last fall, Mr. W. W. McLelland, of the D. & R. G. road, sent out the following circular letter to the other members of the association:

Dear Sir—Since returning from the meeting at Chicago I have asked myself, how can we achieve the greatest success for our association? And to the question, only one answer comes, viz.: Show the officers of the corporations that employ us, that it pays, and has a real money value to them. At no time in my recollection would this be more appreciated than now, when every official is forced by the financial stringency to adopt measures (sometimes disagreeable to them), to save a dollar. Is it not our duty as shop foremen to show them that we can help them save? I believe every foreman has in his shop some tool that is looked upon as his personal "kink," easily made and cheap, that will save many times its cost each month. An old friend once told me that anything worth having was worth asking for. I therefore ask you to send me a sketch, or description, of any tool or labor-saving machine you have, no matter if it is only to bend a staple, providing you look upon it as a special labor-saver on locomotive and car work; don't wait to get a blue print or fancy drawing.

We have in our shop a steam hammer, bulldozer, Oliver's bolt machine and a Bradley helve hammer; any tool you have which may add to the value of either, or a simple tool which may be used on an anvil—anything that will save money for our employers—will be appreciated. Should the opportunity occur, I will gladly reciprocate.

This letter brought a shower of "kinks" of all kinds, shapes and sizes, and a lot of them have been placed at the disposal of Locomotive Engineering, and will be illustrated. As there are a great many of them, as good a time as any to begin is right now. So here is a scheme to bend brake hangers of a peculiar pattern used by Mr. A. L. Woodworth, of the C., H. & D., at Lima, O.

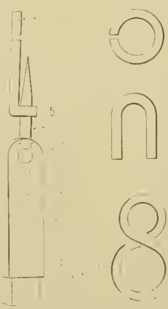


Tool for Bending Brake Beam Hangers.

He does this with attachments to the ordinary steam-hammer dies, as can be seen by the front and side views shown herewith.

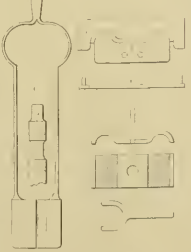
It will be easily understood when it is seen that 1 represents the face of the former, 2 the brake hanger after bending, 3 the gauge and straight piece of iron before bending, 4 the slot that holds rollers in place while at work, 5 elevation of block around which hanger is bent, and 6 front stop to keep iron straight and in place until rollers take it. The peculiar shaped piece is bent in duplicate by simply hinging two long hangers from the top die, a couple of rollers that come down on top of the straight piece of iron, bending it down square, and are then guided through curved slots to close the lower ends together. This tool cost $15, and it will undoubtedly save that over hand work every ten hours.

The same mechanic suggests a simple device for bending staples, tail bolts, key rings and chain links as shown below.



Staple and Link Bender.

Another tool of his is used to make truss plates for iron cars. The complete device is shown in 2. A represents one-half of the die that forms the outside of the plate, B the other half forming the inside. After the plate is bent to the proper shape B is removed and a flat plate, shown at C, is dropped on, the dowels in the end insuring its going in the right place; then punch D is placed in the hole in C and driven through the work by a blow of the hammer, thus forming the piece without drilling. E represents the finished product, the fork shown below is used for handling the block B.



Truss Plate Former.

A larger number of these blacksmith kinks will be shown next month.

One for the Railroad Chemist.

There was a very suggestive remark made by Mr. S. M. Vauclain, of the Baldwin Locomotive Works, when he was discussing the specifications for boiler and fire-box steel. While talking about mistakes made by steel makers in delivering plates of inferior quality to the kind paid for, he said: "It costs very little to analyze a sample from each plate. You can hire a chemist for a great deal less than you can hire a good mechanic at the present time, and you do not have him long before you are willing to pay him the best wages paid about your establishment, after you have once found out the value of such a man. I would suggest that after this report is adopted, each and every master mechanic who can possibly do it hire a chemist and start a laboratory of his own. He can hire him as a mechanic. He will make a first-class mechanic, and he can help his employer to come to conclusions that will be of the utmost value in his shop."

We commend these remarks to the railroad managers who are inclined to hop on chemists and laboratory help as the first step in reducing expenses. Mr. Vauclain knows what he is talking about, and his advice is well worth following.

A Safety Ash-Pan Damper.

Mr. E. H. Marshall, of Fort Madison, Iowa, has recently applied for a patent on a double ash-pan damper, one that allows the damper to be open to admit air on a

level with the top of the pan, and at the same time admits of removing the netting instantly and opening both ends of the pan, on a level with the bottom, to admit of quick and efficient cleaning.

The form of his damper and its operation can be seen from the cut. On the left end of the pan the cover over the netting is open for the admission of air only, on the right the whole arrangement is swung up to admit of clearing quickly.

The pictures of locomotives shown in our May number and called "Swedish Locomotives," were made at Budapest, for the Royal Hungarian State Railways. This correction should have been made in our June number, but was overlooked.

Those Prize Designs.

THE EIGHT-WHEELERS.

As we remarked last month there was little so very new in the designs offered in competition for our prizes [illegible] that the brake valve is handy, and everything is simple and direct, no extra parts being introduced.

THE WINNER.

John Shields Payne was born on the 8th of October, 1868, near Islip, L. I. His parents moved to Wortendyke, N. J., when he was three years of age. He received only a common school education, it being necessary for him to start to work at an early age. He claims the foundation of his mechanical education was obtained from an old Patent Office report and several trade catalogues that he got hold of. He was always especially interested in locomotives, and whenever possible spent his spare time around the railroad shops and on the yard engine. At the age of fifteen he went to work for the Automatic Truck Works, at Midland Park, and when he was seventeen procured a situation in the drawing room of Rogers L. & M. Works, where he learned his trade and has ever since been employed.

THE SECOND PRIZE

was awarded to a designer who would have come in first but for two things—doubts about the inside closing check and locating the air pump too high.

The drawing submitted was by long odds the nicest piece of work of all those offered and was highly complimented by the committee.

The turret used by this designer is placed outside of the cab and only the handles of the valves extend into it.

The cab arrangement of piping is admirable, the fewest possible parts being used.

A steam bell ringer is used and inside closing cocks as shown in detail drawings.

The designer's description says

"All connections for conveying steam from boiler to injectors, steam heater, blower, air pump, water glass and bell ringer are attached to a steam chamber, which is connected to boiler by a flange joint, and has a valve inside of boiler which closes automatically in case the chamber is broken off. This valve is kept open by a rod, which extends to the outside of chamber, and can be used to close connection from chamber to boiler at any time.

"The pipe which runs from chamber to cab is also provided with an automatic valve.

"The gauge cocks, check valves and water glass cock all have their valves located inside of boiler, so that in case of breakage they will remain closed.

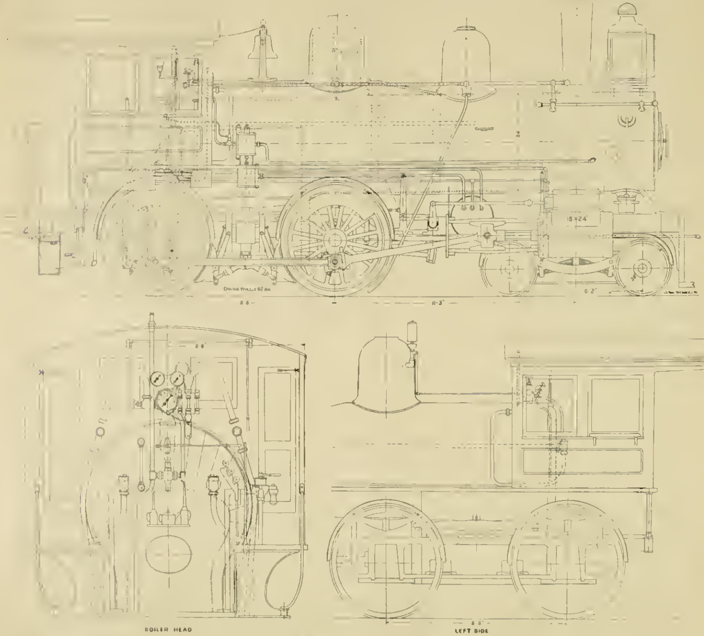
"The water glass is connected at the top with steam chamber by ¾-inch pipe.

"The pipe to whistle has a guard valve inside of dome.

"The blow-off cock is located on the back end of firebox, and a rod extends from it up through deck. The engine is equipped with the Westinghouse automatic air-brake, and compressed air-train signal. The air pump is a 9½-inch improved, and the brake-valve is a model 1892 with feed-valve. The boiler is supplied by two No. 9 injectors.

"The valves and air pump are oiled by a No. 3 triple lubricator.

"The engine has steam bell ringer and chime whistle. The steam pipe to bell ringer is under jacket, and it exhausts into front end.



First Prize for Eight-Wheelers. Won by John S. Payne, Wortendyke, N. J.

[illegible] PRIZE

The design for eight wheeler taking first [illegible] both hands [illegible] things is extremely [illegible] but the details that it was hoped to improve were carefully thought out.

There is nothing on the side of the boiler to get knocked off. The checks are located on the boiler-head, and an open pipe carries the water up toward the front of the boiler.

All the steam is taken from a turret, detail drawings shown herewith.

The designer furnished a very brief description, as follows:

"Checks placed on back head of boiler, where they are less liable to be broken off in case of wrecks.

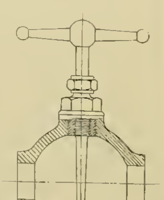
"One triple sight-feed lubricator placed in cab.

"All steam cocks and valves in cab to be screwed into a turret having an unusually light neck, which is likely to be broken in a collision or wreck, at the same time allowing the valve to close to prevent the escape of steam.

"Hand brake placed on right side of tender.

"For further particulars consult drawing."

It will be noticed that the air pump is lowered to get it out of line of engineer's



Emergency Valve for Turret, Used in First Prize Design.

"All studs screwed into boiler have a weakening groove cut outside, so that they will break off instead of pulling out.

"Branch pipes are made of seamless brass, and all other piping to be copper, except pipes for air, which are iron.

"The Brotherhood spring seats are used. The seat boxes are alike on both sides of engine.

The designer says

"A small steam dome is placed on boiler in front of cab, from which all steam connections are made, with the valve handles running through the cab (to be handy).

"This dome being placed behind the main dome would be protected in case of a collision.

"The throttle is run to the left side of the

The throttle arrangement was considered good, and some of the committee were strongly in favor of placing air pumps on the left side on all engines.

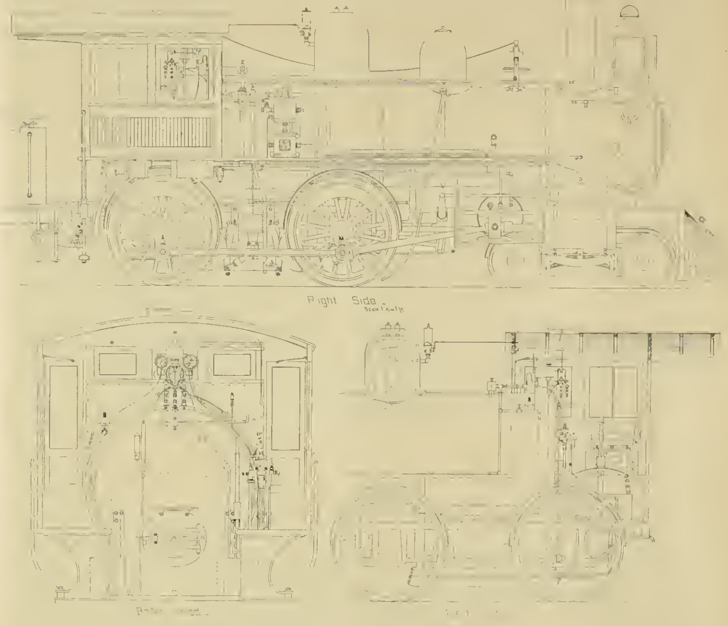
THE WINNER.

W. A. Eagles, is a resident of Newark, N. J., and is 22 years of age. He served his time in the D., L. & W. shops at East

"Hunted for a B'ar."

BY HUGH SHARP.

Lum Prentiss, who had been reading the editorial bear story in the June number of LOCOMOTIVE ENGINEERING, volunteered a bear story on his own account. Lum, before this story, had the reputation of lying



SECOND PRIZE FOR EIGHT-WHEELERS. WON BY FRED. M. WESCOTT, OF TOLEDO, O.

"The upper part of steam-gauge bracket is left blank for mirror, clock, or additional gauges, if wanted.

"The front windows are held open in any desired position by a slide and thumb screw, the back windows lower down like street car windows.

"The tank hand-brake is on right side and has automatic dog. The opening in deck for grate shake lever is covered by a hinged plate.

"The steps on engine and tank are the same distance from rail, 14½ inches, the other step on tank is half way from bottom step to deck of tank. The back driving springs where they protrude into cab are covered by iron boxes."

THE WINNER.

Fred. M. Wescott, a native of Toledo, O., twenty-three years of age. He attended the Toledo High School, and went to the Manual Training School for two years, where he learned all he knows about drawing. He is employed as a fireman on the Wheeling & Lake Erie Railroad.

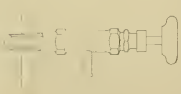
THE THIRD PRIZE

was awarded to a design with more changes from the ordinary than either of the other two.

dome and arranged with bell cranks to lift the valve. With this arrangement very little packing would have to be done, and the lever would pull very easy.

"The air pump is placed on left side, out of the way of engineer.

"The boiler check is similar to that used on the Pennsylvania Railroad, and made so as to grind in with steam on. Auxiliary reservoir for front truck brake to be placed on top of truck frame, with rubber connections. The brake wheel on tank to



SAFETY GAUGE COCK.

hang in an upright position, to be more out of the way of fireman.

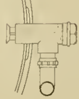
"The steam-heat regulator is placed under cab on left side, and to have the handle run in cab."

Buffalo, N. Y., under F. B. Griffith, M. M., and is now employed as a draughtsman by

the Meyer-Sniffen Co., of New York, manufacturers of plumbing supplies.

We will show the design of the consolidation engines next month.

We can furnish all back numbers for 1894—no more.



CHECK.

less than any [illegible] runner between Texarkana and El Paso.

"For b'ar stories," commenced Lum, "men mostly hunts the b'ars; sometimes the b'ars hunts the men. But, say, hev any of you fellers ever bin hunted fer a b'ar? No? Wal, I hev.

"In 1875, before the T. & P. went further than Fort Worth, I was out in Callahan county after wolf scalps. The X and Y ranches paid $2.50 for coyotes and $5 for loafers. I trapped, shot and hunted, and generally made good money. One mornin' in January I concluded to go round my traps. I'd bin down with grip—'breakbone fever,' as we called it then—and put on a long buffalo overcoat and a coonskin cap, against gettin' chilled. Them days I turned my whiskers loose, and between the coon cap and the buffalo coat, and bein' nat'rally hairy about the face, I came mighty nigh gettin' into trouble that same mornin'.

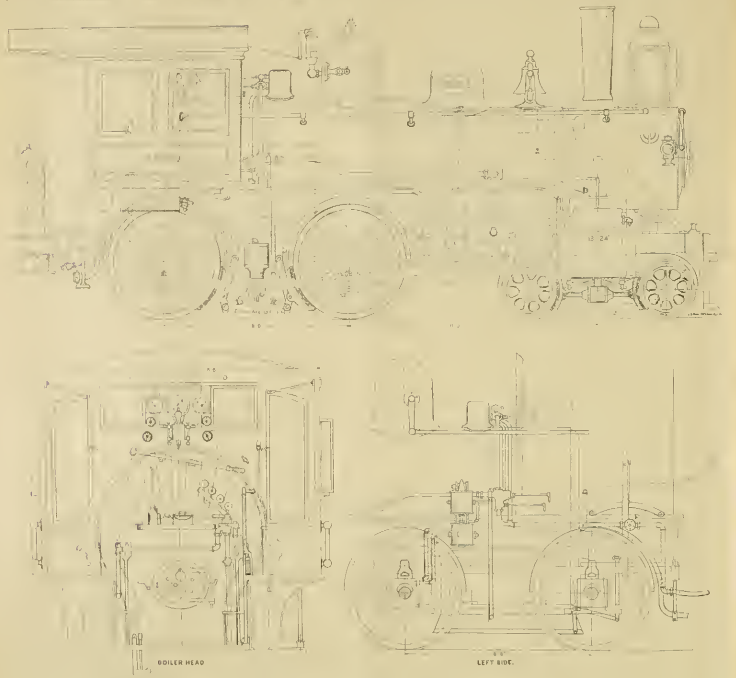
"I'd bin out two or three hours, and was just yankin' a dead polecat from a trap, [illegible] not [illegible] anything [illegible] to amount to [illegible] account of the [illegible] heard a shot no great ways [illegible] the next moment a bullet [illegible] head—missed me about a [illegible] I didn't [illegible] up to make [illegible] heard [illegible] m[illegible] about [illegible] some [illegible] that [illegible] it, but I remembers I had [illegible] whilst [illegible] was talkin next I commences shootin [illegible] 'em an [illegible] lesson in [illegible] Hello [illegible] got [illegible] then [illegible] huntin yer the hull mornin. We [illegible] bead on you twice, when you was [illegible] on, but didn't fire because we heard b'ars took a lot of killin from the tail end. We apologize.

Lum's best friends admit he has strained his reputation badly.

sleep in the street, then the cops would pull us in for vags, the judge would ask us what we had to say for ourselves and we'd just produce the Sea Beach time-table."

"Well, what then?"

"Why, he'd sentence every man to forty days' sleep."



[illegible]

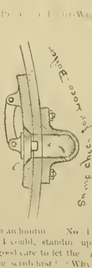
[illegible] which lay right [illegible]

[illegible] couple of tender feet [illegible] they were [illegible]

[illegible] I guessed [illegible] a human, when [illegible] they sees that [illegible] flat [illegible] at [illegible] mighty sudden [illegible] hole through my [illegible]

"Wal, I couldn't [illegible] and I was another man huntin. No [illegible] whispers as [illegible] as I could, standin up, but takin mighty good care to let the 44 show up above the scrub first! 'Why [illegible] it ain't Lum Prentiss,' says they together.

'Lum old cock, we sure took you fer a bloody b'ar in that rig out, and hev' ben



Sand [illegible]

A Way Out.

The train crews on the Sea Beach Railroad have been trying for some time to get another crew put on and the hours of service reduced, but with little show of success.

Several plans were suggested at a recent meeting, but none of them was considered likely to convince the management.

One brakeman rose and said he had a plan. They demanded it.

"Well," said he, "we might all go to

According to a report submitted to the Master Car Builders' Convention on "Heating Passenger Equipment," there are about 6,000 passenger cars in the country which are heated by steam. With the large proportion of the balance heated by the Baker heater, it would appear that safety methods have made most satisfactory progress in the last five years.

We want the addresses of all the survivors who ran or fired locomotives, or held other positions in the mechanical department of the military roads, during the war of 1861-65.

Practical Letters from Practical Men.

Facts Wanted. There's a glut of Opinions.

Write on one side of the paper, state your point plainly and briefly, and then quit. We supply the generalities. No letters noticed unless name and address are annexed.

From the Rajputana-Malwa Railway of India.

Editors:

Being a subscriber to your LOCOMOTIVE ENGINEERING, I have taken the liberty of sending you a photograph of one of our mail and passenger train engines, with a full description of the class of engine, hoping you may find a corner in your paper for the same when convenient.

The engine shown is our class "M" for meter gauge, or 39⅜ inches, and used in our mail and passenger service.

These engines were built by Dubs & Co., Glasgow, in 1880, and were put to running in the latter end of that year.

They are inside cylinder engines, with driving and leading wheels 4 feet 6 inches in diameter, coupled, the leading end of the boiler being on an Adams bogie. The fire box is flat tapped with vertical stays. They are fitted with Allan's straight link motion which wears less, and is much easier to reverse than Stephenson's common shifting convex curved link or Gouch's stationary concave curved link. It is found that the lead with Allan's motion is not exactly constant for all grades of expansion, as in Gouch's, but it is far less variable than is the case with Stephenson's, besides the link and die block being straight are much easier repaired than curved ones; the steam chests of these engines are on the old system, between the cylinders, the latter are 14 inches in diameter, with a 20-inch stroke. The big ends are of the ordinary marine type, with a cap and long bolts, for holding the brasses together, straps and cotters being dispensed with. The webs of the steel crank-axles are strengthened by iron straps which have been shrunk on, the crank-axles are 6½ inches in diameter. There is a compensating beam between the driving and trailing wheels, and the weight being carefully distributed the engines run remarkably easy, the bogie in front enabling it to round curves without any torsion whatever. The engines are fitted with a good steam-brake in addition to the ordinary brakes, they are capable of running at high speed, and hauling heavy loads, the boilers carry a pressure of 140 pounds to the square inch.

These engines have done excellent work, the load for mail being twenty carriages, and on ordinary passenger trains, twenty-four; the average speed for the former trains being thirty miles, the latter twenty-eight miles an hour. The road is heavy on some sections, grades of 1 in 150 being common. The writer has ridden on these engines when they were running forty-eight miles an hour, with a light special train, of course. The construction of our line and the narrow gauge is not adapted to fast running.

Coal consumption per train mile with country coal is 19.75, with English coal, 17.50 per mile.

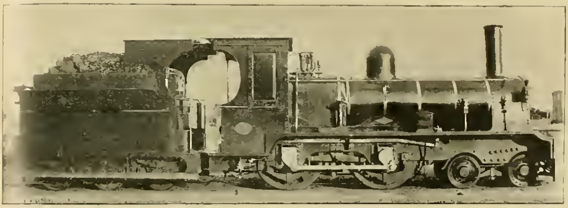
The engines are much liked by the drivers, their average day's work being 135 miles. We have a hot, trying climate for seven months in the year, and 135 miles is considered a good day's work.

The photo was taken by Mr. Joseph Sheffield, one of the "drivers," who runs one of this class of engines. "Engineers" you call them in America.

Locomotives do not always stay on the line in India, as will be shown by the snap shot accompanying.

ALEXANDER WALKER,
Locomotive Foreman.

Bandikui Junction, India.



CLASS "M" LOCOMOTIVE, RAJPUTANA-MALWA RAILWAY OF INDIA.

WRECK ON A STATE ROAD IN INDIA.

They Might Wear Lightning Rods.

Editors:

I would suggest that a good way to effectually dispose of train robbers would be to give them a good dose of "lightning."

This could be carried in the express car bottled up in the shape of a storage battery, at a high potential, say a thousand volts.

The car floor could be made of sheet-iron, having the express box insulated from it, and then connecting the box to one side of the battery and the car floor to the other side, everything is ready for the reception of the "Dime Novel Heroes."

When called upon to deliver his treasure, the messenger could invite the heroes aboard and to help themselves, then throwing a switch, stand back and watch them dance for his edification as they make futile attempts to lay hands on the box.

In place of the storage battery, a battery with a powerful induction coil would do the work quite effectually and very cheaply, the "juice" from one such being warranted to tie a bandit in a double bow-knot and put him far beyond any idea of dollars or gold brick.

Or, again, the platform irons might be insulated and arranged to place his highness in circuit when he plants his regulation boots on the step and grasps the handles, and so teach him to do a backward vault, after which he would not be in a hurry to run away, but might be a fit subject for the nearest coroner, who might return a verdict of "didn't know 'twas loaded."

SAM. H. LIBBY.

Schenectady, N. Y.

[This device could be depended upon to kill trainmen regularly, and to insure the use of dynamite before a robber would look at a car.]

Back Pressure and Compression.

Editors:

In your July issue, "P. S.," of Wheaton, Minn., asks the difference between back pressure and compression, and you answer, "They are the same." I do not understand it so. Back pressure is a resistance on the exhaust side of the piston, caused by the friction of the escaping steam while the exhaust is still open. Compression does not begin till the exhaust is closed. Back pressure is an evil; but compression, within certain limits, is a benefit to any engine, and absolutely necessary to an engine running at high speed and having large clearances, as it brings the heavy reciprocating parts to rest without shock, and reheats the cylinders and steam passages.

TOWNSEND POORE.

Scranton, Pa.

[Compression and back pressure are both resistance to the piston, but the distinction noted by our correspondent as above is correct.]

The Cannon Ball Theory of Speed.

Editors:

I differ somewhat with your answer to the last part of question 94 in last month's number, about an engine being the same heft while running as while standing still.

Take for instance a ball thrown through the air. While it is under swift enough motion it will not come to the ground at all, but as soon as the speed begins to slacken, the force of gravitation begins to draw it to the ground. Now, is this not on the same principle as the locomotive case, and if not, why?

ROY F. FRARY.

Holden, Mo.

[The speed of the cannon ball makes no difference with its weight, nor does it change the force of gravitation—the ball commences to fall the instant it leaves the cannon. If your theory were correct, we would only need to run fast enough to enable our heaviest trains to run over hoop-iron rails and cornstalk bridges with safety.]

A Sand Remover.

Editors:

I have recently piped a ten-wheeled engine so that a jet of steam can be thrown on the rail behind each back driver. In pulling heavy trains, where much sand is used, this little jet prevents its getting under the wheels of the train and causing it to pull hard. The steam and water seems to lubricate the flanges just enough to make train pull easier on curves and seems to cause a saving of wear on rails and wheels. Why is not this a good thing on any engine?

GEO. M. TOWER,
Foreman Loco. Dept.

Fitchburg, Mass.

[These jets have been used with good results in many places, and it seems to us would be a simple and cheap improvement on any road locomotive.]

Proposed Plan to Load the Locomotive on the Gross Weight of Train.

Editors:

It was an interesting discussion in the May issue of LOCOMOTIVE ENGINEERING, started in the New York Railroad Club by a paper from Mr. Geo. W. West, Superintendent of Motive Power of the New York, Ontario & Western, on "What is the Most Economical Load for the Locomotive from the Standpoint of the Motive Power and the Transportation Departments."

It is the first time I have ever seen in print any mention made of this long-neglected problem, and just why we make a study of almost every minute detail in every department of the service and have neglected this most important subject, and continue to load the locomotive in the same primitive fashion of fifty years ago, making no effort to adopt a better system, is in my opinion, past understanding.

Just how the "average yardmaster" is to load the locomotive properly, when every official from the general manager down makes no distinction between the gross weight of one car weighing 90,000 and another weighing 45,000 (either one representing a car), except the accounting department [illegible] per [illegible]—per shekel.

When it is taken into consideration what the railroad companies lose daily, especially some of the trunk lines having sixty to eighty trains per day, each way, on account of power not being loaded to the maximum limit, and on account of power being overloaded, causing delay, waste of fuel, etc., has not the time arrived for the inauguration of a better system to load the locomotive?

Mr. West implies that the officers of the motive power department are at the present time very anxious to show on paper that the engines under their supervision make the greatest number of miles at the least expense, and do this in order to keep up their reputation to the same standard as men on other roads, regardless of the fact that the companies may or may not earn any money from this kind of service.

Also, that the officers of the transportation department are equally as anxious to show that their vigilance and zeal has not [illegible], and that they are hauling as many [illegible] at the present time with less power [illegible] they did several years ago, even if [illegible] do occasionally overload.

[illegible] Engineer Smith with the "172" "lays [illegible] nobody knows what the gross [illegible] weight of that train was, and Conductor [illegible] simply wires "no steam," when it could have been reported an overload. With such a system in vogue, would it not be better to enable the men in charge of the motive power and transportation departments, in order to keep up their reputation with other men, to adopt a system [illegible] load the locomotive on the gross weight [illegible] basis and not from the standpoint of the motive power and transportation departments, as outlined by Mr. West? [illegible] and Mr. Mendenhall favor [illegible] by weight or tonnage, but these [illegible] are not discriminating enough [illegible] how this shall be done, or what [illegible] they have made to assist the "or[illegible] yardmaster" who they claim, "is [illegible] discriminating enough in assigning [illegible] quickly and [illegible] load the locomotive [illegible] gross weight of train."

Mr. Wattson intimates that on the West [illegible] the yardmaster has the way-bills, [illegible] weights on the way-bills regulated [illegible] number of cars assigned to the engine. I am not familiar with the amount of [illegible] done on the West Shore, but if [illegible] all the yardmaster has to load trains [illegible] will frequently, when he gets rushed, [illegible] the formality of adding up the weights, and just measure off a mile of [illegible] more or less. If Mr. Wattson will [illegible] take the trouble to copy the weights [illegible] about forty way-bills and add them up, he will readily see that his yardmasters on the West Shore, in the rush of business have not sufficient time to adopt any such a plan to load power by.

Even where it would be possible to do this, we still would have another difficulty to overcome. The weight of the cars is also an important factor in the case. At the present time we have cars of the 30,000, 40,000, 50,000 and 60,000 lbs. capacity, the average weight, 17,000, 22,000, 26,000 and 31,000 lbs. respectively, the standard car of the nineties doubling the weight of the car of the seventies.

It will be readily seen, with such a variation in weight of cars, that when we do adopt a tonnage basis to load the locomotive, we will have to include the weight of not only the freight in the car, but the car itself.

To inaugurate a new system for loading the locomotive in the manner proposed, may at first appear very difficult, and not so easily accomplished, but with a determined effort in the proper direction, this can be so simplified that any yardmaster can quickly assign to the locomotive a train exactly rated to per thousand pound.

To do this the motive power department and the transportation department should require the accounting department to furnish, with every car load they offer for movement, a way-bill with the gross weight entered on it. Where the lading consists of light merchandise the lading should be estimated, and, with the light weight of car, should constitute the gross weight, with every way-bill thus showing the gross weight. We next need a piece of mechanism, called an adder, so we can quickly determine the number of cars needed to load the engine of a train by gross weight. With this mechanical device, we can not only load the locomotive on the per gross weight of train basis, but can do it with accuracy, speed and precision, not over the limit or under the limit, not in the interest of the men of the motive power department, or in the interest of the men of the transportation department, but in the interest of the company, "that pays the bill," and I might add, in the interest of Engineer Smith, Conductor Jones and the "172."

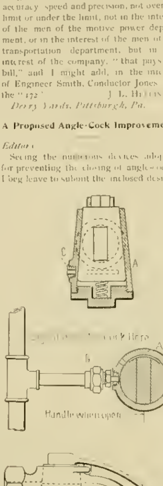
J. L. H[illegible].

Derry Yards, Pittsburgh, Pa.

A Proposed Angle-Cock Improvement.

Editors:

Seeing the numerous devices adopted for preventing the closing of angle-cocks, I beg leave to submit the inclosed design.



All that is required of any plain angle cock is to drill two holes in casing, as shown in drawing, one for a branch to signal pipe and another for an exhaust port, also an exhaust cavity in plug, which can be milled, or can be cored-out when made new, this must be low enough to avoid making connection with train-pipe. The object of cavity in plug is to connect signal line to exhaust port when angle-cock is closed or half closed, which causes reduction and notifies engineer.

The ports and cavity should be made sufficiently large so as to make a very noticeable reduction, which may be indicated on a gauge in cab, so as to not confuse the turning of a cock with conductor's signal.

J. E. M[illegible].

Ft. Wayne, Ind.

A Point or Two on Firing.

Editors:

I have just read a letter in your June issue of LOCOMOTIVE ENGINEERING, written by H. L. Clark, Atchison, Kansas, giving his experience as a locomotive fireman.

I thought I could give some advice to firemen who read your valuable journal as to soft-coal firing. Mr. Clark's idea may be all right on one engine, but there are many different kinds of fireboxes. You may have two engines built just alike to the letter, and still have to fire both differently. I claim there is just as much science in handling a soft-coal fire of a locomotive as any trade a man may go at.

To become a practical soft-coal fireman a man must first "get the hang of her." He must learn to see his fire just as soon as he opens the furnace door, and to feed it as needed, not too fast or too heavy, then again he should watch the engineer, and learn how he is working the engine. It takes some men a long time to learn that point, and it's the most important of all.

An engineer may be working an engine comparatively easy with his fireman throwing coal, but the result of this often is, that his fire is buried over and the steam is going back on him. He then has a hard time to get back to full pressure and there is a waste of coal.

Again, the fireman should know the shutting-off places and never use his hook on the fire just before an engineer shuts off. Wait until he leaves the station and gets his engine "cut back," then use the hook if necessary. This will save labor and coal.

Another point in the economy of coal and labor is to keep the coal wet down, and around stations to keep the damper down. This will apply to fireboxes with arch brick.

In regard to the long fireboxes—say the twelve-foot furnace—these are handled very differently. As this class of engines will pull their fire ahead, you will find, if you throw your coal ahead, that you will soon have your flue sheet covered. Bad coal will make clinkers in any furnace.

I think that these facts in regard to soft coal firing, if practiced will give good results. I have stood on the footboard of a heavy fast train for over twelve years and have always had plenty of steam, which I got easily and with an economical use of coal.

E. J[illegible].

[illegible], Pa.

Tapping out Staybolts.

Editors:

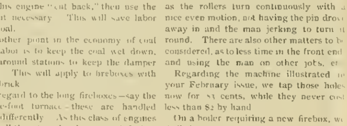
Herewith find the drawing of a staybolt hole tapping attachment to a flexible shaft I use here. The only limitation to the speed with this is what the taps will stand. Here we are not supposed to exceed 175 revolutions per minute. This will advance the tap 14½ inches per minute, but with good lard oil, and two or three taps, so no time is lost in changing and the taps have a chance to cool between times, they can be run considerably faster.

With lard oil and two taps, 1⅛-inch, we tapped 122 holes in 95 minutes. That would be at the rate of 150 revolutions per minute if kept going continuously. For the throat sheet I have the compound box used, illustrated in January issue (this is used for tapping all the holes in a great many shops) and use the fastest speed for the shaft, viz., 300 revolutions per minute, and as this box is geared 2¼ to 1, the tap will advance 4¼ inches per minute—*quite a difference.* I think the drawing is plain enough to be understood, but I will explain it. *A* is a socket with a square hole in one end to hold the tap, the other end is turned down to ⅞ inches in diameter and 3¼ inches long for the loose sleeve *B*. On the end of this again, it is turned down to ¾ inches in diameter and 1⅞ inches long with a right hand thread cut on it to hold the clutch *E*. *B* is a sleeve with a ring turned on one end. This ring in knurled so the man can hold it, and is loose so *A* is free to turn when the clutch engages. *D* is the pin to hold the clutch in working contact. *C* is an oil hole. *E* is the clutch, and must be made to suit the shaft. It is tapped with a ¾-inch tap, right hand thread, and screws on after *B* is in position, and is practically a part of *A*.

In your February issue, a gentleman questions the use of the machine for rolling flues by power on account of the cost. As he asked the opinion of others, I waited to hear them before telling just what it will do. We rolled a large set of flues in three hours and forty minutes, altogether I allow four hours for the work. This with two men, the operator at 17½ cents, and the man rolling at 25 cents, equals 42½ cents per hour, this comes to $1.70, the operator, with a boy at 10 cents per hour, can put up and take down the machine in one and one-half hours comfortably, cost 42 cents, total cost rolling flues, $2.12. By hand, nine hours, at 25 cents, equals $2.25. Exclusive of the cost, I think it makes a far better job, and is easier on the men as the rollers turn continuously with a nice even motion, not having the pin drove away in and the man jerking to turn it round. There are also other matters to be considered, as to less time in the front end and using the man on other jobs, etc.

Regarding the machine illustrated in your February issue, we tap those holes now for 53 cents, while they never cost less than $2 by hand.

On a boiler requiring a new firebox, we drilled 828 staybolts (heads on this required a depth of one inch), these were ⅝-inch holes, and were drilled previous to breaking, fifty countersunk rivet heads, drilled so the heads would drop off in backing out the rivets, twelve corner plugs in the mud ring, drilled clear out and twenty-six holes, 1⅛ inches in diameter, on the wagon-top for new crow-feet for crown-bar braces. This drilling was done with a drill frame that required a support like a ratchet. This drilling cost $16.75, this includes bringing, setting, and taking a[way]



tools, etc., away to place. On the same boiler we broke 628 staybolts, average 1⅛ inches, on the side sheets, the back head was removed, cost, $4.95, this includes handling the tools, and the men had a snap that day.

Dubuque, Iowa. J. C. MILLER.

Studying Air-Brake Problems — Are Standards Sacred?

Editors:

There is one or two things in the July number that it seems could be improved on a little, without contradicting or criticizing in a carping spirit the writer, who is furnishing us with precisely the information needed on this subject, and in much better shape probably than any other who might attempt to perform the task undertaken, still, as it does not seem to be just right to remain silent in such a case, I will endeavor to point out the mistakes.

Referring to piston ring No. 48, Plate

126, of the 1894 catalogue, the statement is made that these rings do not fit air-tight. I have not yet found one of these valves which were tight, with handle on lap and train-pipe exhausted, but a few years ago there was a number of engines here with the Plate D8 valve, which, if the piston No. 17 were oiled with a heavy oil, would when the handle was on lap and train-pipe empty retain the air so that the black hand would remain stationary for a reasonable time when the engine was standing, but while running, owing to vibration, would not do so well.

The other point which it appears necessary to take up is the tender-brake rigging illustrated on page 241, Plate 24. Suppose an apprentice seeking after knowledge on the air-brake should, when he goes home at night, study up the plan presented that he might have a better understanding on the subject. We have all been there, and this is about the way it goes. After supper he takes his dividers, rule and paper, and tries to find what size the brake cylinder is, probably by measuring the length of reservoir and comparing it with the length of brake cylinder, suppose he decides the reservoir to be 12 x 33 in. and the brake cylinder 10 in., which his W. A. B. instruction book, page 34, tells him will give about 4,000 lbs. on the piston end of cylinder lever, his rule shows him the short end of lever, or the one next to the cylinder is 7/16 in. long and the long end about 14/16 in. long, to find the power on the long end of the lever he multiplies 4,000, which is power in cylinder, by 7, cylinder end of lever, and divides by 14 or the truck lever end getting 2,000 lbs. pull on the rod leading to top end of rear live truck lever, which measures about 3/32 in. on short end and 15/32 on long end, or 18/32 in all, to find the power on brake beam he divides the short end into total length, which gives him a proportion of 6 to 1 or 12,000 lbs. on each pair of wheels; then looking at the cylinder rod he sees the lever for the front truck is fastened to the hand-brake rod instead of the front head and the cylinder rod connects very near the center; to find the pull here he adds the pull at both ends of the cylinder lever or the one connected to piston, which gives him 4,000 + 2,000 = 6,000 lbs. pull on cylinder rod, and as the holes for the hand-brake rod and front live truck lever are at the same distance from the center or cylinder-rod hole, it follows that the power is divided equally and each end gets 3,000 lbs., as the front and rear truck levers measure alike; by multiplying by 6, proportion of truck levers, he would get 18,000 lbs braking power on each pair of wheels on the front truck, or 12,000 lbs. more for this than the rear truck, and understanding probably that most tenders weigh less by 1,000 lbs. on the front end than the rear, he is brought to a standstill. Perhaps he endeavors to figure this out as equipped with an 8-in. brake cylinder and 10 x 24-in. reservoir; from page 55 of his instruction book he finds 2,500 lbs. is the pressure, then 2,500 × 7 ÷ 14 = 1,250 × 6, proportion of truck lever = 7,500 lbs. on each pair of wheels on rear truck, for the front truck he gets pull on cylinder rod as before, which is 2,500 + 1,250 = 3,750 lbs., pull on center of lever at the front end of cylinder rod, this divided by 2, proportion of hand-brake rod and truck lever, lever = 1,875 lbs. pull on the top end of front live truck lever or 625 lbs. more than the pull on the top end of rear live truck lever, it is evident then that the end of lever connecting to front live truck lever should be twice as long as the end connecting to hand-brake rod, to be in proportion with the lever at the rear end of cylinder rod, and if the boy is not sure of his plan, he is liable to go wrong. Some of these boys are pretty old, too.

In response to friend Wood, page 237, I cannot agree with him when he infers that we should strictly follow in all cases the recommendations of different companies, no man or company is infallible, and I frequently catch points from those who have not the slightest idea of the operation of the part they are commenting upon. When lacking positive information on a subject, whether it be air-brake or anything else, it is best to go by the instructions offered by those who are best posted, which in this case would be the makers. The tender-brake rigging herein discussed, however, emphasizes the importance of not blindly taking for granted anything, but to carefully examine, and if it differs from what you believe it should be, to post yourself on the subject. You will detect an error in the work, or have added to your store of knowledge, usually the latter, and in either case will be the gainer.

Roanoke, Va. GEORGE HOLMES.

On the Travel of the Crosshead.

Editors:

In the June number of LOCOMOTIVE ENGINEERING, Mr. B. H. Hawkins comments upon the travel of "crosshead" in forward and back stroke while making a revolution of wheel, but gives no explanation of how he gets at the result.

Mr. H. says a crosshead will travel 24 inches less than half the circumference of the wheel in the back stroke, and will gain 24 inches more than half the circumference of the wheel in the front stroke, which I think is right.

I have drawn a rough sketch representing the path of crank-pin. (No. 1.)

This sketch represents a wheel 2 inches in diameter and 1-inch stroke. The circumference of this wheel is about 6¼ inches.

I start the wheel revolving with the pin on front center *A* and move her to the back center *C*, which is the back stroke,

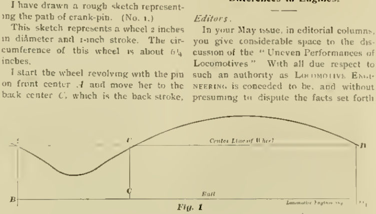


Fig. 1

and the curved line from *A* to *C* represents the path of crank-pin in traveling from front to back center when engine is going ahead, or the back stroke. I find that the crank-pin has traveled 2⅛ inches, which is 1 inch less than one-half the circumference of the wheel, and in moving wheel from back center *C* to front center *D*, pin has described the long curve and I find the pin travels 4⅛ inches, which is 1 inch more than half the circumference of wheel. This is caused by top part of wheel traveling further than the part on the rail. The crank-pin travels the same in proportion to its height from the rail. The crank-pin in the bottom stroke is traveling in the part of the wheel that is moving the shortest distance. This is shown in sketch No. 2, which shows two crank-pins, one pin on the back center *A*, the other on front center *B*. By making one-half stroke the back pin will travel from *A* to *D* and the front pin will travel from *B* to *C*. This will show you that the pin on the top stroke travels twice the distance that the pin on the bottom stroke travels and illustrates Mr. Hawkins' idea.

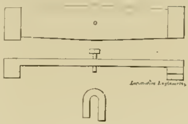
WM. MCCLELLAND.

Marquette, Mich.

A Blade Straightener.

The blade straightener shown by Mr. Arthur in the May number is, as he says, a very convenient tool for the man who uses it, and a very economical one for the company who owns it. The convenience of the tool would be much greater if there were no pins to lose, and I send you a sketch of one which has been in use on this road for some years, the idea of which, if I mistake not, emanated from the fertile brain of Mr. Geo. Gollmar, of the Gollmar Bell Ringer Co., who was at that time gang boss in the Baraboo shops of this company. The ends are turned as shown, only from opposite edges, so that no matter what the width of the blade, the set-screw comes in the middle.

I have often puzzled my brain, without practical result, over some plan for twisting the blades on ten-wheel and consolidation engines where it is almost impossible



to get the ordinary forked arrangement on without taking down the forward brake rigging, and then the blade has to be clear forward. If some one has been more fortunate in results than I, let us hear from him.

F. W. PETERSON.

Boone, Ia.

Differences in Engines.

Editors:

In your May issue, in editorial columns, you give considerable space to the discussion of the "Uneven Performances of Locomotives." With all due respect to such an authority as LOCOMOTIVE ENGINEERING is conceded to be, and without presuming to dispute the facts set forth therein, still, I think there were a few things touched upon briefly, which will admit of discussion. "Chain-ganging engines," you say, "has dissipated the belief that engines built from the same templates and general dimensions varied in efficiency." This subject I have often heard brought up by men handling engines, and it is remarkable how many men will agree as to certain engines being "good" and certain others N. G. There may be, as you say, some defects that would lead to such verdicts, but, allowing that an engine that handles easy, cuts off square, with neatly fitting rod brasses, boxes that do not knock or pound, and above all an easy rider, generally earns a good reputation, still the fact remains, that no matter how well kept up some engines are they do not "appear" to haul trains as easily as others, built apparently precisely the same and under the same conditions. I could name a dozen engines here that the boys, if they had their choice, would never pick out to make a day on, though they may be good steamers. One thing noticeable about some engines is, that an injector, when working half capacity, will feed the boiler when hauling an average train, and on other engines of the same class exactly, the same size and kind of injector will not supply the boiler when working full. This is not temporary, but is the general experience, and the engines come to be noted as being "awful hard on water" or the reverse, as the case might be. I have examined feed hose myself to see if strainer was partly clogged or tank valve out of order. These injectors, like the engines, were made from the same templates, possibly by the same person, yet even when speed is taken into consideration, apparently there is great difference in action. While on this subject I will say a few words about an editorial opinion published some time ago in LOCOMOTIVE ENGINEERING, referring to an engine hauling a given load, regardless of distribution of weight. The opinion expressed was that an engine would haul a train composed of empties and loads just as easily with empties next to engine as next to caboose. I am not prepared to say, mind you, that an engine will haul a train easier with loads next to engine, but it certainly does "appear" to me to do so, especially up grade and around curves, and in conversation with many railroad men, all seem to be certain of it. However, it is taken for granted that the resources of LOCOMOTIVE ENGINEERING would enable it to prove, by means of the dynamometer, the pulling powers of engines under any and all circumstances, and, of course, to be able to back up its assertions by actual figures, if necessary. In my own mind I had about reached the conclusion that chain-ganging engines had strengthened the belief, etc., instead of dissipating it, although common sense would seem to teach a person that with the same forces we should be able to produce like results. As stated in your article, if all things were considered, and the actions of different engines analysed, possibly some reason would be found for their behavior, and in the case of injectors, some scaly formation or sediment might reduce standard ports or passages by which the supply could be changed in volume.

Assertions like the above made in the editorial columns sometimes stir up a little adverse criticism among the boys when it is first sprung on them, but it sets 'em all thinking, anyhow, and incites them to further investigation.

Pittsburgh, Pa. JOHN BRICE.

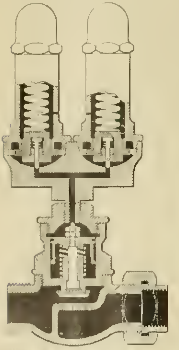
[There is a reason for everything, and when two locomotives "exactly alike" are found in practice to do different work, careful investigation will always prove that they are quite different in some important particular. We know of a case where one engineer claimed he could not pull a full train without working his injector full; the man on the opposite run ran his injector half shut off (the engines were sisters), and discussion was rife. Careful measurements were made *in the tank*, when it was found that both injectors were throwing the same amount of water. A long train of cars, the head half empties, *will* pull harder on curves and uneven tracks because of the increase of flange friction, etc., but on a straight, dead level there will be no difference. LOCOMOTIVE ENGINEERING is a good long way from being infallible, and when it gets men to think about and discuss practical questions it has filled part of its mission.]

Is This an Improvement?

Editors:

Inclosed please find blue print of arrangement of pump governor Charles Brown, a young machinist, and myself have rigged up on the engine I am running on the St. L. & S. F. Ry. As you will notice, it is the Westinghouse pattern, using a new double centre piece and two complete tops. One controls train pipe, the other main reservoir pressure. As you well know, should the steam valve to pump be well open, when handle is pulled around and slight reduction made, pump will start to racing, accumulating considerable pressure in main drum, depending on length of time handle is left on lap; now, when release is made by throwing high drum pressure into comparatively low train pipe pressure, distortion of diaphragm in and trouble with pump governor results.

This happens on long grades quite often, and there have been cases of the engineman going to dinner and leaving handle on lap without easing off steam to pump. Some men claim it to be an advantage to be able to accumulate a high drum pressure while brake is set descending long grades. With the proposed arrangement, a small stop cock placed in cab could be used to cut out and render main drum governor inoperative for the time being. With both governors working, however, it would be quite impossible to secure more than 70 pounds in train line. With the new D 5 brake valve, with governor connected to main drum pressure, the feed-valve attachment takes care of train pipe pressure. However, should the feed valve attachment become out of order, or the engineman carry handle in full release, he



[illegible] train pipe charged with say 90 [illegible] and shut that wheels will be the [illegible]. This addition could be made to [illegible] governor with but slight addition [illegible] cost, and it would seem as though [illegible] thing of the kind were needed in connection with the older style of brake-valve [illegible] excess spring, and could also be used [illegible] advantage where the new D 5 valve has [illegible] introduced.

Monett, Mo. C. P. CASS.

Will They Want New Tires?

Editors:

We have been very much interested in the picture in your magazine for June of the springs that were ruined by rubbing against the driving-wheels of locomotive, and which were returned by the railroad on account of not having worn up to the guarantee, and which the manufacturers were asked to replace. We think your remarks regarding them well-timed. We wish you could have presented your readers with an illustration of how the tires had worn by rubbing against the springs also. No doubt it will be in order next for the manufacturers of the tires to furnish a new set on account of the tires having the flanges worn thin. Such a demand would not be any more absurd than some of the demands that are sometimes made upon the tire manufacturers.

ALEX. J. PETRI,
Superintendent Midvale Steel Co.
Philadelphia, Pa.

Some Remarkable Work on a Fast Run.

The Atlantic City Railroad is a branch of the P. & R., running from Camden to Atlantic City, a distance of 55.5 miles. Its terminals are at tide water, but it is more or less hilly, the grades, however, being rather light and not long.

For some time now one of the World's Fair engines, exhibited by the Baldwin Locomotive Works, has been making fast runs there—but any old tub will make a fast run now and then. It is the average work that is wanted, and so we asked for the running sheet for a whole month, and the performance of this engine for June, both ways over the road, are given below. It will be seen that the weight of train is given in thousand pounds for each day.

Performance of Compound Engine No. 694, Atlantic City Railroad, during month of June, 1894.

SOUTHWARD—55.5 MILES.

June, 1894	No. of Cars	W'ght of train incl. Engine and Tender	Time Leaving Camden Schedule 4.10 P. M.	Time Arrive Atlantic City Schedule 5.10 P. M.	Running Time	Miles per hour incl. delay
		T. M.	H. M. S.	H. M. S.	MIN.	
1	6	[illegible]	4 1[illegible]	5 [illegible]	[illegible]	[illegible]
2	7	[illegible]	4 1[illegible]	5 [illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	4 1[illegible]	5 [illegible]	[illegible]	[illegible]
5	6	[illegible]	4 1[illegible]	5 [illegible]	[illegible]	[illegible]
6	6	[illegible]	4 1[illegible]	5 [illegible]	[illegible]	[illegible]
7	6	[illegible]	4 1[illegible]	5 [illegible]	[illegible]	[illegible]
8	6	[illegible]	4 12 [illegible]	5 [illegible]	[illegible]	[illegible]
9	7	[illegible]	4 1[illegible]	5 [illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	4 1[illegible]	5 [illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	4 1[illegible]	5 [illegible]	[illegible]	[illegible]
13	6	[illegible]	4 1[illegible]	5 [illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	4 1[illegible]	5 [illegible]	[illegible]	[illegible]
15	7	[illegible]	4 1[illegible]	5 [illegible]	[illegible]	[illegible]
16	10	[illegible]	4 1[illegible]	5 [illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	4 1[illegible]	5 [illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	4 1[illegible]	5 [illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	4 1[illegible]	5 [illegible]	[illegible]	[illegible]
21	7	[illegible]	4 1[illegible]	5 [illegible]	[illegible]	[illegible]
22	7	[illegible]	4 1[illegible] 45	5 [illegible]	[illegible]	[illegible]
23	11	[illegible]	4 1[illegible]	5 [illegible]	[illegible]	[illegible]
25	7	321 [illegible]	4 14 [illegible]	5 11 [illegible]	[illegible]	58 9
26	[illegible]	347 [illegible]	4 12 [illegible]	5 08 00	56 [illegible]	54 4
27	7	321 5	4 10 [illegible]	5 07 00	56 5	[illegible]
28	7	321 5	4 18 [illegible]	5 17 00	54 5	[illegible]
29	7	321 5	4 10 [illegible]	5 07 [illegible]	56 5	58 9
30	8	464 [illegible]	4 11 45	5 15 00	63 15	52 0
Av'age.	7	[illegible]			56 6	58 8

During the month the train was delayed several times at W. J. Crossing, notably on the [illegible] and [illegible]th.

NORTHWARD—55.5 MILES.

June, 1894	No. of Cars	W'ght of train incl. Engine and Tender	Time Leaving Atlantic City Schedule 7.45 A. M.	Time Arrive Camden Schedule 8.43 A. M.	Running Time	Miles per hour incl. all delays
		T. M.	H. M. S.	H. M. S.	MIN.	
1	5	[illegible]	7 45 00	8 43 [illegible]	58 5	56 9
2	6	[illegible]	7 45 00	8 44 30	59 5	56 [illegible]
4	[illegible]	347 [illegible]	7 45 00	8 44 00	[illegible]	[illegible]
5	6	[illegible]	7 45 [illegible]	8 46 00	61 [illegible]	54 [illegible]
6	6	[illegible]	7 45 00	8 46 00	61 [illegible]	54 6
7	7	[illegible]	7 45 00	8 45 30	60 5	55 [illegible]
8	6	[illegible]	7 45 00	8 43 00	58	56 9
9	[illegible]	[illegible]	7 45 [illegible]	8 45 30	60 5	55 0
11	[illegible]	[illegible]	7 45 00	8 43 00	58	57 4
12	6	[illegible]	7 45 00	8 44 00	59 0	56 4
13	6	[illegible]	7 45 00	8 44 00	59 0	56 4
14	6	[illegible]	7 45 [illegible]	8 49 00	64 0	*52 2
15	[illegible]	347 [illegible]	7 45 [illegible]	8 44 00	59 0	56 4
16	6	347 [illegible]	7 45 00	8 44 00	59	56 4
18	8	[illegible]	7 45 00	8 43 45	58 75	56 7
19	6	[illegible]	7 45 [illegible]	8 45 [illegible]	60 [illegible]	55 5
20	6	[illegible]	7 45 00	8 43 [illegible]	58 5	56 9
21	6	[illegible]	7 45 00	8 43 [illegible]	58 5	56 9
22	6	[illegible]	7 45 00	8 43 15	58 25	57 2
23	6	[illegible]	7 45 00	8 43 [illegible]	58 5	56 9
25	8	431 [illegible]	7 45 00	8 44 30	59 5	56 0
26	6	[illegible]	7 45 00	8 43 30	58 5	56 9
27	6	[illegible]	[illegible] 45 00	8 44 00	58 0	57 4
28	6	[illegible]	7 45 00	8 43 30	58 5	56 9
29	6	347 [illegible]	7 45 00	8 43 00	58	57 4
30	6	[illegible]	7 45 00	8 43 00	58 0	57 4
Av'age.		347			59 2	56 2

*Delayed seven (7) minutes at Farmington by air-hose bursting.

FAST EXPRESS ENGINE, ATLANTIC CITY RAILROAD.

The general design of the engine can be seen from the engraving. The fuel is anthracite coal.

The following are the general dimensions of the engine and tender:

WEIGHT AND GENERAL DIMENSIONS.

Total weight of locomotive in working order, including two men (actual), [illegible] lbs.

Total weight on driving wheels (actual), [illegible],700 lbs.

Total wheel base of locomotive, [illegible] ft. 4 in.

Distance between center of front and back driving wheels, [illegible] ft. [illegible] in.

Distance from center of main driving wheels to center of cylinders, 12 ft. [illegible] in.

Length of main connecting rod from center to center of journals, 8 ft. ½ in.

Transverse distance from center to center of cylinders, 7 ft. 4½ in.

CYLINDERS, VALVES, ETC.

Diameter of cylinders, H. P. 13 in., L. P., 22 in.

Stroke of piston, 24 in.

Horizontal thickness of piston over piston-head and follower plate, 4¼ in.

Kind of piston packing, cast iron rings sprung into solid head.

Diameter of piston-rod, 3½ in.

Size of steam ports, 24×1½ in. circular.

Size of exhaust ports, 24×4½ in. circular.

Greatest travel of slide valves, 5 in.

Outside lap of slide valves, H. P. [illegible] in., L. P. ⅞ in.

Inside lap of slide valves, H. P. ⅛ in. negative, L. P. none.

Lead of slide valves in full stroke, H. P. ⅛ in.; L. P. ⅛ in.

Throw of upper end of reverse lever from full gear forward to full gear backward, measured on the chord of the arc of its throw, 45¾ in.

Sectional area of opening in each steam pipe connected with cylinder, 19.64 sq. in.

WHEELS, ETC.

Diameter of driving wheels outside of tires, 6 ft. 6 in.

Diameter of truck wheels, 4 ft.

Size of driving-axle journals, diameter and length, 8½×12 in.

Size of truck-axle journals, 6½×10 in.

Size of main crank-pin journals, 5½×6 in.

Size of coupling-rod journals, F. 5½ in. diam. × 4 in. long, B. 6 in. diam. × 4 in. long.

Length of driving springs, center to center of hangers, 4 ft.

BOILER.

Description of boiler, straight.

Inside diameter of smallest boiler ring, 56½ in.

Material of barrel of boiler, steel.

Thickness of plates in barrel of boiler, ⅝ in.

Kind of horizontal seams, butt jointed, with double covering strips.

Kind of circumferential seams, double riveted.

Material of tubes, iron, No. 13 B. W. G.

Number of tubes, 324.

Diameter of tubes outside, 1½ in.

Distance between centers of tubes, 2⅛ in.

Length of tubes over tube plates, 10 ft.

Length of firebox inside (Wootten type), 9 ft. 6 in.

Width of firebox inside, 8 ft. [illegible] in.

Depth of firebox from under side of crown plate to bottom of mud ring, [illegible] ft. 3½ in.

Water spaces, sides, back and front of firebox, 3½ in.

Material of outside shell of firebox, steel.

Thickness of plates of outside shell of firebox, ⅜ in.

Material of inside of firebox, steel.

Thickness of plates in sides, back end and crown of firebox, all 5/16 in.

Material of firebox tube sheet, steel.

Material of smokebox tube sheet, steel.

Thickness of front and back tube plates, ½ in.

Crown plate is stayed with radial stays 1⅛ in. diam.

Diameter and height of dome, 27½×24 in.

Working steam pressure per square inch, 180 lbs.

Kind of grate, water tubes and cast iron bars.

Width of bars, ½ in.

Width of openings between bars, ½ in.

Grate surface, 76 sq. ft.

Heating surface in firebox and combustion chamber, 173 sq. ft.

Heating surface of tubes, 1,262 sq. ft.

Total heating surface, 1,435 sq. ft.

Kind of blast nozzle, variable.

Diameter of blast nozzles, 3½ in.

Smallest inside diameter of smokestack, 18 in.

Height from top of rails to top of smokestack, 14 ft. [illegible] in.

Smokebox, short, with register in front.

TENDER.

Weight of tender empty (actual), 33,800 lbs.

Weight of tender with fuel and water, full, 80,975 lbs.

Number of wheels under tender, eight.

Diameter of tender wheels, 36 in.

Size of journals of tender axles, diameter and length, 4½×8 in.

Total wheel base of tender, 16 ft.

Distance from center to center of truck wheels of tender, 5 ft. 4 in.

Water capacity of tank (in gallons of 231 cubic inches), 4,000 galls.

Fuel capacity of tender, 6 tons.

ENGINE AND TENDER.

Total wheel base of engine and tender, 47 ft. 3 in.

Total length of engine and tender over all, 62 ft. 4½ in.

Express Locomotive Practice in England and America.

BY HUGH SHARP.

Though the different conditions of service prevailing in England and America do, to a certain extent, account for divergence of locomotive practice in the two countries, it is nevertheless a fact that even where the conditions are practically similar English and American designers have usually designed on radically different lines. Reference to Mr. Buchanan's express practice on the N. Y. C. and Mr. Dean's on the English Great Western, will illustrate this point. Here gradients, speed and weight of trains are sufficiently alike to make it possible for an identical type to deal with both services equally well. The Empire express is the fastest train in the world, and the Great Western's "Zulu" (which does a little better than the same company's famous old "Flying Dutchman"), nearly equals it in actual running time, though its numerous stops bring down the average considerably. The weight of both trains, exclusive of engine and tender, is about 160 tons. For climate only do the conditions materially differ, the American winter being decidedly more severe than the English.

The "999" is so familiar to the readers of LOCOMOTIVE ENGINEERING that no description of it is necessary; but the few particulars of the Great Western engine which follow will enable them to compare two of the latest types of English and American locomotives, and to note that they have hardly a single feature in common except that both are non-compound. The Great Western engine has only one pair of driving wheels, 92 inches in diameter, loaded to 40,000 pounds, the truck is absent, and in its place are a single pair of 54-inch carrying wheels and there are a similar pair under the foot-plate, the frames are slab, with all journals outside the wheels, the cylinders are 20 x 24 inches, and are placed between the frames with steam chests beneath, heating surface, 1,442 square feet, working pressure, 160 pounds; total weight of engine alone in working order, 100,000 pounds. Reckoning the M. E. P. at 75 per cent. of the working pressure, or 120 pounds, the tractive force will be,

$$\frac{20^2 \times 24 \times 120}{92} = 12,521 \text{ lbs.}$$

The working pressure of the "999" is 190 pounds, and the M. E. P. will therefore be about 142 pounds, its tractive force with 19x24-inch cylinders and 86-inch driving-wheels, will be

$$\frac{19^2 \times 24 \times 142}{86} = 14,[illegible] \text{ lbs.}$$

Taking into consideration the somewhat greater average train resistance of the Empire express, it will be seen that both designers agree as to the amount of tractive force that their respective engines should have. But there is a very great discrepancy in the amounts of the adhesion provided—the Great Western engine, with 40,000 pounds only on its driving-wheels, having less than half that of the "999," which has 84,000 pounds. The older authorities give the adhesion as one-fifth the weight on the drivers, under ordinarily favorable conditions. If this rule is correct, the English engine with adhesion of 8,000 pounds would slip directly its tractive force exceeded 8,000 pounds, unless sand were used; but sanding is not found necessary except on a greasy rail. Other authorities maintain that a greater proportion of the weight on the driving-wheels than one-fifth can be depended on for adhesion, and it is certain that the performance of this and many other English "single" engines, as well as data obtained in dynamometer experiments, prove the soundness of their views. The adhesion of the "999," unlike that of the Great Western engine, is considerably in excess of its tractive force, even under the old rule, one-fifth of 84,000 being 16,800 pounds. It appears, therefore, that this celebrated engine is either excessively heavy or is under-cylindered. It weighs 124,000 pounds, and it is not self-evident why, with abundant heating surface, the cylinders were not 21 x 24 inches, which would have given it a tractive force slightly in excess of its adhesion.

$$\frac{21^2 \times 24 \times 142}{86} = 17{,}213 \text{ lbs.}$$

The English engine is lighter than the American by 24,000 pounds. As it is about as powerful, this great difference is remarkable. It may be attributed to three features: slab frames in place of bars, a single pair of leading wheels instead of the heavy four-wheel truck, and the much lighter casting required for inside cylinders. I estimate that there is here a saving of 18,000 pounds, and that the remaining 6,000 pounds is accounted for by the smaller boiler. Looking at these figures, it is worth while inquiring if we are not too much wedded to outside cylinders, bar frames and trucks, and if inside connection slab frames and the absence of a truck would not be an improvement on the present practice of roads where the conditions are practically the same as those obtaining in England. For many years English designers have had the benefit of the finest road-beds, and the typical English express engine is a survival of the fittest. Half a century ago, when rails were light and ballasting only nominal, bar frames and outside cylinders were very common in the old country; but with improved tracks bar frames disappeared totally, and outside cylinders at the present day are quite the exception. On the New York Central and some other systems that might be named with it, the tracks have been improved to such an extent that they are now ahead of anything in England; yet the finest engines are, with few exceptions, simply developments of types that were originally designed to work under conditions which have now passed away forever. Steel rails of 80 pounds to the yard and upwards, and rock ballasting are comparatively things of yesterday with us, but they have been common in England any time during the last thirty years, therefore the compact, boxed-up, rigid English locomotive, the outcome of long experience, should be—and is, I believe—better adapted for such tracks than the types we are familiar with.

This criticism will be unwelcome to those who have the mistaken notion that the value of engineering facts is, in some way, dependent upon patriotic or local prejudice. Nor do I wish to suggest that the English design is superior to our own, except in the arrangement of cylinders and in the form of the frames. Their low running-boards, for instance, are altogether bad, and their cabs, and the foot-plate arrangements generally, are inferior to our own. The groundless fear of raising the center of gravity too high is the cause of their fireboxes always being sunk between the driving axles; and, as a consequence, coupling rods, even with boxes of moderate dimensions, are extravagantly long. Thus, the new Northeastern express engines, whose boxes are only 6 feet inside, have rods 111 inches long. Whilst the use of trucks is not increasing in England, probably more than half the passenger engines have them. Webb, of the Northwestern, prefers a leading radial axle. These axles are lighter, give equal flexibility, and permit larger centers being used if carried well ahead of the cylinders, as in the Baldwin P. & R. compounds and the same firm's "special high speed" type. A single pair of axles is not too heavily loaded at 20,000 pounds, the weight on trucks seldom exceeds this, and in such cases there seems no good reason for employing four wheels with an independent frame where two would do the work. Inside cylinders have these advantages over outside—first, the great saving in weight; secondly, losses from condensation are much reduced, as cylinders and steam chests are inclosed in the smokebox, which is brought down below the barrel for this purpose; thirdly, inside connected engines are steadier, laterally, and are consequently easier on the track. Where accessibility is not of the first importance there is everything to be said in their favor. Slab frames are cheaper than bar; they are lighter, the material is better distributed, and by their use the width of the firebox can be increased from 4 to 6 inches. Single driving-wheels are still largely used in England, but they are not seen in any other part of Europe. It is claimed that these engines run easier and are lighter on repairs than when coupled. Most engines of this class are fitted with Gresham's steam sand-blast, which is kept in use constantly; the G. W. "single," referred to in this paper, works without this artificial increase of adhesion.

Intercepting Valve of the Richmond Two-Cylinder Compound.

The two-cylinder compounds recently built at the Richmond Locomotive Works, and in service on the C. & O. and C. C. C. & St. L., have an intercepting valve designed by Mr. C. J. Mellin, the chief draftsman, illustrations of which are here presented.

The drawings show sections through the low-pressure cylinder saddle, with the valves in their various relative positions. The high-pressure cylinder exhausts into the receiver, which is placed inside the smokebox, and opens into the chamber *F*. The intercepting valve, as shown at *V* in the several views, has a piston on its forward end, which acts in its cylinder as an air dash-pot, to prevent any slamming of the valve. Around the stem of this valve is a sleeve *L*, which has an axial movement on the stem, and acts as an admission and reducing valve to the low-pressure cylinder when starting and when working simple. Valve *H* is a plain winged valve with a piston on its rear end, and is called the emergency valve, as by its use the engineer can, at will, operate as a simple engine. When starting, steam from the boiler goes to the high-pressure cylinder in the ordinary way, and also to the port *C*, through a 2-inch steam-pipe connected to the dry pipe. There is then no pressure in the receiver *F*, and the pressure on the shoulder *E* of the sleeve *L*, Fig. 2, moves the sleeve and valve *V* to the right, closing the receiver, and letting steam past the shoulder *E* into the low-pressure valve chest *G*.

Now since the area of the end *B* of the sleeve *L* is, say, twice that of the shoulder *E*, half of the boiler pressure will move the sleeve *L* to the left, cutting off steam from port *C*, and thus equalizing the work in both cylinders. After, say, one and a half revolutions, the pressure accumulates in the receiver *F* and moves the valve *V* to the left, carrying the sleeve with it, when, the steam being permanently cut off at *C*, there is a straight connection between the two cylinders. In starting on grades, or when exerting maximum power, the engineer can move the three-way cock in the cab, letting boiler steam behind the piston on the emergency valve *H*, and holding it open against its spring. This exhausts the small cavity *J*, in which the pressure is equalized with the receiver through holes in the valve *V*, and then the valves *V* and *L* move instantly to the right, assisted by steam pressure on the shoulder *E*. The high-pressure cylinder has now a separate exhaust, and the low-pressure cylinder gets its steam direct from the boiler through the port *A* and reducing valve *L*. Except when working simple, the valves act entirely automatically. The lubricator to the low-pressure cylinder enters port *A* and thus insures constant lubrication to the intercepting and reducing valves.

Owing to the small area of port *C*, and the contracted exhaust through *H*, the engine developes less power as a simple engine than as a compound, at a speed of over, say, five miles an hour, and thus the runner is compelled to work compound. Should either side break down, the emergency valve can be opened and the engine brought in on one side like an ordinary engine.

We are indebted to our neighbor, the *American Engineer and Railroad Journal*, for the use of this engraving.

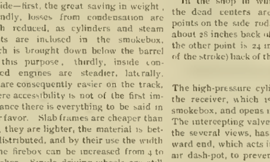


FIG. 1.
POSITION IN STARTING AUTOMATICALLY

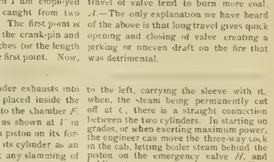


FIG. 3
POSITION WHEN WORKING COMPOUND

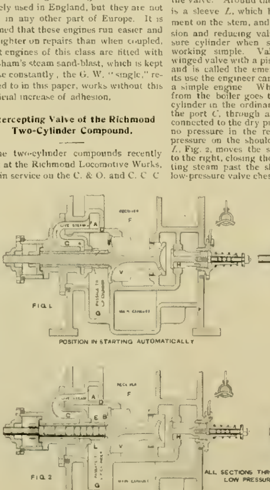


FIG. 2
POSITION IN STARTING AT MAXIMUM PRESSURE IN L. P. STEAM CHEST

ALL SECTIONS THROUGH SADDLE OF LOW PRESSURE CYLINDER

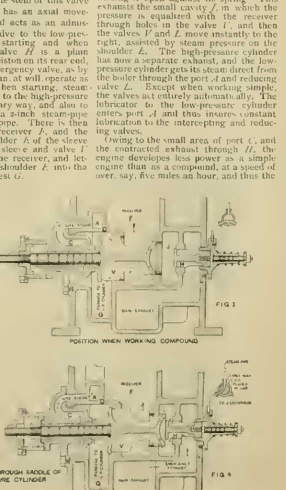


FIG. 4
POSITION WHEN WORKING AS SIMPLE ENGINE

? A. What You Want to Know. ? A.

Don't ask questions that simply require a little figuring to determine; make each question separate. No notice taken of anonymous questions.

(117) S. B., Buchanan, Iowa, asks

Who should a person apply to for position as fireman on a road? *A.*—The master mechanic or roundhouse foreman.

(118) R. W. M., Charlestown, Mass., asks:

Does the valve travel any faster when an engine is hooked up to six inches than it does when traveling its full throw—engine running at the same speed? *A.*—No. As the valve makes one complete movement back and forth to every revolution of the wheel, it stands to reason that it must travel fastest when it moves the longer distance. Moving six inches and back in a second, say, it must travel faster than it would if it traveled two inches and back in the same time.

(119) J. S. G., Frankfort, N. Y., writes

In the shop in which I am employed the dead centers are caught from two points on the side rod. The first point is about 28 inches back of the crank-pin and the other point is 24 inches (or the length of the stroke) back of the first point. Now, the motion of a crank-pin through the air when running is somewhat like a wave, or a number of connected semicircles, and I claim that owing to the peculiar motion of the side rods that the dead centers cannot so be accurately obtained. Am I right? *A.*—We do not understand what you mean.

(120) G. A., Princeton, Ill., writes

I notice in railroad papers that experience in increasing the travel of locomotive valves and adding lap makes a smart engine, but wasteful of fuel—that is for a 6 or 6½-inch valve travel, while a 4 or 4½-inch travel acts to make an engine logy but economical of fuel. I notice this opinion was given by the S. M. P. of the Old Colony road and others. If this is so, there is a reason for it. What is the reason? Please explain why should merely increasing the travel of valve tend to burn more coal. *A.*—The only explanation we have heard of the above is that long travel gives quick opening and closing of valve creating a jerking or uneven draft on the fire that was detrimental.

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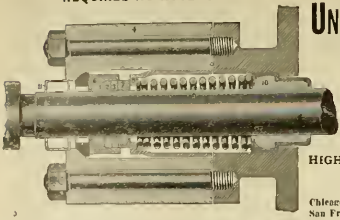

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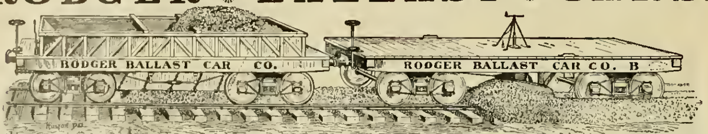

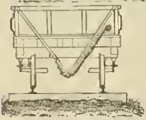

These cars are 34 feet long, and are built either 60,000 or 60,000 lb. capacity, M. C. B. Standard. They carry from 18 to 20 cubic yards of gravel or broken stone. In using them no ballast is thrown in the ditch, and none is wasted, as the precise amount of ballast needed can always be discharged. A train of 25 cars, carrying 600 yards of ballast can be unloaded and the ballast distributed, leaving the track perfectly cleared and flanged, as shown in the cuts, in from 12 to 15 minutes. This is all done by the regular "train service" (a conductor and two brakemen), no extra help being required. The track is perfectly cleaned by the spreader, so that a train can immediately pass over it at any rate of speed, without meeting any obstruction. No aprons are needed; no wire cables are used. There is no shoveling ballast from between the cars, and no cleaning the tracks with shovels. The ballast is left between the ties and on their ends, directly in position for tamping, when the track is raised, without being shoveled in from the ditch. The average saving per mile, in the amount of ballast needed to make a "raise" of 10 or 12 inches, will be about 400 yards, and often far exceeds this. The total saving per mile in material, labor, time, use of cars, saving in transportation, etc., is found to amount, in gravel, to from $250 to $400, and in broken stone it often amounts to $500.

These cars are in use on the Great Northern Ry., the Illinois Central, the Gulf, Colorado & Santa Fé, the Chicago & Eastern Illinois, the Penn. Lines West, and other roads.

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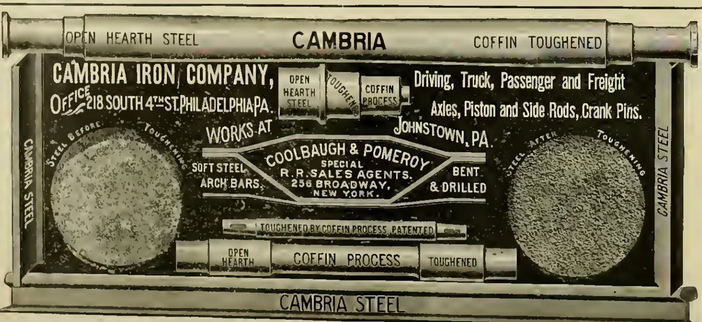

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OUR ENGRAVINGS.

Of late we have had a great many inquiries as to who made the fine half-tone plates shown each month in LOCOMOTIVE ENGINEERING. Credit is due the expert anywhere and we are glad to recommend the engravers of our plates to those wanting good work at reasonable prices. All the half-tones and reproductions we use are made by the STAR ENGRAVING & PRINTING Co., 607 & 609 Sansom St., Philadelphia, Pa. SINCLAIR & HILL.

Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock.

VOL. VII, No. 9. NEW YORK, SEPTEMBER, 1894. 20 Cts. Monthly $2.00 Per Year.

The Largest Mogul Locomotive in the World.

We present herewith an engraving of the largest mogul in service anywhere—one of ten recently built by the Baldwin Works for the Delaware, Susquehanna & Schuylkill road.

The engine was designed by Daniel Coxe, Jr., superintendent of the road, and is a fine example of a modern freight locomotive, embodying, as it does, all the latest improvements, and having every convenience for the safe and expeditious handling of very heavy freight trains.

Firebox, 132⅞ in. long, 42 in. wide inside, 3-in. water space on sides, 4-in. back and front.

All short stays in boiler drilled.

Crown supported by radial stays 1 in. diameter, 4½ in. between centers.

Rocking grates in three sections.

Short extension smoke arch.

Two-wheeled engine truck has 36-in. steel tired wrought iron wheels, with journals 6 in. diameter and 12 in. long.

Nathan triple sight feed lubricators

Jerome metallic packing.

Cast steel crossheads, Ajax metal bearings.

Crosby safety valves (3).

Air bell ringer

Four gauge cocks.

Westinghouse air brakes, with American outside equalized driver brakes, 9½-in. pump.

Tender, 6-wheeled, wrought iron, steel tired wheels 42 in. diameter, brakes on all wheels. Janney coupler on tank. National hollow brake beams.

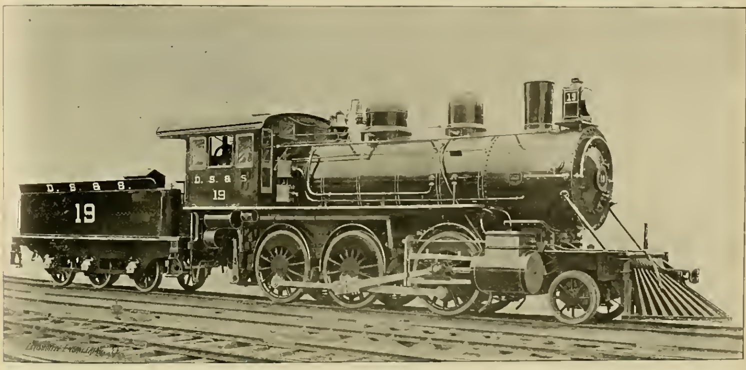
Capacity of tank 4,000 gallons.

Tender axles, steel, journals 6¼-in. diameter, 10. in. long

The P. R. R. standard (3 bars) connection between engine and tender is used.

springs on top of each box, the center and back pair equalized.

The materials selected for these engines has been the best to be had, the design presenting some new features, and the size and weight going beyond any precedent. They were intended to pull coal trains from Roan, the central point on this road, to Perth Amboy, N. J., over the Lehigh Valley road. There was a misunderstanding about this arrangement, as the bridges of the L. V. were not ready to stand such heavy engines, and the L. V. R. R. bought six of the engines and have them in heavy freight service on the northern division of the road. The four in service on the D., S. & S. are each handling two of the trains formerly hauled by the old 19 x 24 moguls.



THE LARGEST MOGUL LOCOMOTIVE IN THE WORLD, D., S. & S. RAILWAY.

It may not be generally known that the D., S. & S. is owned by the Coxe Bros. & Co., a coal mining concern, and there are some sixty odd miles of main line, all on their own land.

The general dimensions of the engine are as follows

Cylinders, 22 x 28 in.

Drivers, 62 in. diameter, all flanged.

Gauge of track, 4 ft. 9 in.

Fuel, lump anthracite.

Wheel base, engine, 22 ft. 5 in.

Driving wheel base, 14 ft

Wheel base of tender, 11 ft. 6 in.

Total length of engine and tender, 62 ft. 7 in.

Weight, total, 151,000 pounds.

Weight on drivers, 136,000 pounds.

Weight of tender (loaded), 90,000 pounds.

Boiler, made throughout of flange plates, homogeneous cast steel ⅝-in. thick; 72 in. diameter at smallest ring, straight, longitudinal seams butt jointed with double welt strips, all rivets hand driven, button set, dome placed in center, pressure 160 pounds per square in.

Tubes, 270, of iron 13 wire gauge, 12 feet long, 2¼ in. diameter.

Slide valves, Richardson balanced.

All drivers are flanged with 5½-in. tread Krupp crucible steel tires 3 inch thick.

Axles, steel, with journals 9 in. diameter and 12 in. long.

Driving boxes of steeled cast iron, with Ajax bearings.

Side rods of steel, oil cups forged on.

Crank pins, steel, Coffin toughened process.

Injectors, Little Giants, No. 10, 1889 pattern, both on right side

Cab of steel with ventilator, ceiled and wainscoted with ash.

Leach air blast sander.

Penna. R. R. standard whistle.

The jacket, outside of cab, is painted, like the rest of the engine and tender, Brunswick green.

It will be noticed that all the latest improvements are to be found on these engines.

The throttle lever stands up behind the reverse lever, the pair of them looking something like a man and a ten-year-old boy, the throttle stem is outside the boiler connecting to the operating lever on side of dome as plainly shown.

The frames are remarkably heavy, especially in front of and around the cylinders, they do a great deal of heavy pushing.

The 6-wheeled tender has long elliptic

Some anxiety was felt as to their effect on the track, as the rails are only 60 pounds per yard, but the road department say they can see no difference

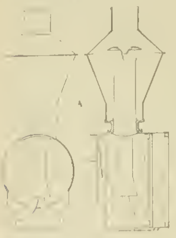
Mr. Coxe is very enthusiastic about the 6-wheeled tanks, they ride splendidly, have never had a hot box, and are simpler and cheaper than the double truck tender.

The Traveling Engineers' Association will meet in Denver, September 12th. This meeting promises to be well attended, and, the subjects up for consideration being particularly interesting, it is bound to be a great success in a mechanical way. We hope every superintendent of motive power will insist on his traveling engineer going, as he is bound to pick up information enough on the trip to pay his year's salary in money saved to the company. The J. P. just aches to go to Denver to be with the boys, but the S. P. still lingers on the "banks 'o bonnie Doon" and Denver is out of the question—we can't even go to Coney Island.

Reminiscences on Locomotive Smokeboxes, Exhaust Nozzles and Stacks.

BY W. H. THOMAS.*

One of the difficulties met by the early locomotive builders was in getting the



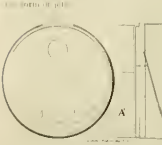
A

[illegible] draft for the fires, it being found [illegible] natural draft was insufficient.

[illegible] was applied to blow the fire (from [illegible] but the arrangement was cumbersome and unsatisfactory.

[illegible] exhausted into the stack was tried [illegible] a forced draft which answered [illegible] and has been used, in many [illegible] to-day.

[illegible] the exhaust pipe was first [illegible] probably not quite certain, [illegible] the drawings of Stephenson's [illegible] seem to indicate that the pipe entered the stack or chimney near the top [illegible], at the side, and probably [illegible] the exhaust shot upward in the form of [illegible].



A'

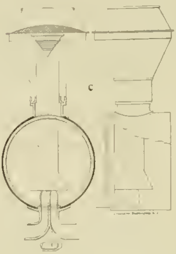
With the forced draft the engines evidently threw fire, for in 1837 we find a cone used with a "curled-over" edge to deflect the sparks, the smokestack being wide and having a wire net or bonnet over it—the cone also being expected to keep the wire bonnet from being cut out by the sparks.

Probably with the small engines there was little or no trouble because of one part

B

of the fire getting a greater effect from the forced draft than did some other. As the size of fireboxes increased this difference became apparent, and means had to be taken to overcome the difficulty, and the origin of the "lift or petticoat pipe" is explained. This raised or lowered would increase the draft through the lower flues and decrease it through the upper flues, or the reverse, and thus enable its manipulator to equalize the strength of the draft at front and back end of the firebox.

This lift-pipe was made in a variety of shapes, as is shown by various sketches, but all intended to reach the same end.

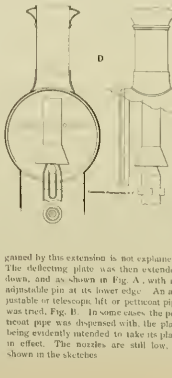


C

The smokebox was about the same size as the boiler in diameter, and long enough to take the stack base at the top, and to hold the cylinders, which were, and still are, fastened to it.

The sparks arrested by the cone and netting were supposed to be caught, and very many of them were, in the wide topped stack, which was built in many shapes, some very fantastic, and many with ingenious details.

As early as 1859 an engine was built with a slightly extended front end, as shown in Fig A, and with it a deflector plate covering the top rows of flues—the top of the nozzles being just above the lower flues. Just what was intended to be gained by this extension is not explained. The deflecting plate was then extended down, and as shown in Fig. A', with an adjustable pin at its lower edge. An adjustable or telescopic lift or petticoat pipe was tried, Fig. B. In some cases the petticoat pipe was dispensed with, the plate being evidently intended to take its place in effect. The nozzles are still low, as shown in the sketches.

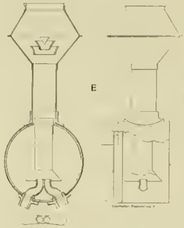


D

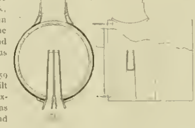
Figs. C, D, E, F, G and H show a variety of forms of the lift pipe, perhaps the extreme being Fig. H, when five flounces are shown.

Other Figures I, J, K, L, M, N and O, show cases where the lift-pipe was done away with and other means of equalizing the draft substituted.

It will be noticed in Fig. L that a deflector or "baffle" plate is placed in front of the flues, while the exhaust pipes have been raised up to about the level of the top flue. A netting was placed from the deflector just below the top of the nozzles, extending in front of the nozzle, level to about where the front of the smokebox formerly was, and then curving to top of the smokebox, which was extended as shown.



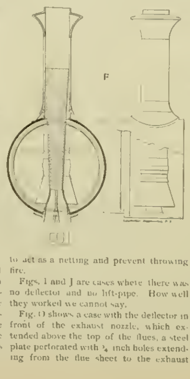
E



I

Fig. K shows another form, where the nozzles are lower and are in a "basket" or perforated casting extending from the netting about half way from it to the bottom of the smokebox. There is no deflector here.

Fig. F shows a case where, inside the lift pipe, which extended very low, was an inverted perforated steel cone which was attached to the top of the nozzle and extended up the stack nearly half way to its top, and was expected to act as a netting and prevent throwing fire.

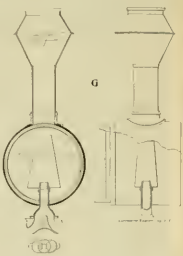


F

Figs. I and J are cases where there was no deflector and no lift-pipe. How well they worked we cannot say.

Fig. O shows a case with the deflector in front of the exhaust nozzle, which extended above the top of the flues, a steel plate perforated with ¼ inch holes extending from the flue sheet to the exhaust nozzle, while in front of the nozzle is a wire netting extending to the front and up to the top of the smokebox. This deflector will be noticed to have its lower part adjustable.

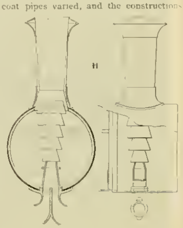
The forms of the stacks are various. Just why would be hard to tell, though doubtless the makers may have had reasons of greater or less value to them for the form.



G

Form or material alone would seem to be of little value so far as consumption of fuel is concerned, and yet in the annual report of one road, some years since, the managing officer said to his stockholders that they had adopted a new cast iron stack which would insure 10 per cent economy in fuel.

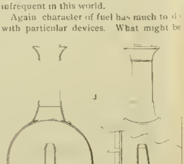
Form, in connection with other items, may have its influence. There has been much question as to sizes both of stack and lift-pipes, opinions varying greatly. Views on forms and sizes of both stack and petticoat pipes varied, and the constructions



H

were almost as varied as the master mechanics. It is quite possible that frequently opinions were formed and then experiments were made to prove their correctness. We find cases of this kind not infrequent in this world.

Again character of fuel has much to do with particular devices. What might be

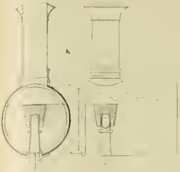


J

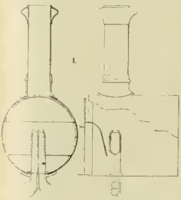
called successful with good fuel and under one train of conditions, under other circumstances and with poor fuel would quite likely be less successful.

* Superintendent of Motive Power, Southern Railway Co. (E. T., V. & G.), Knoxville, Tenn.

It was the fortune of the writer to have to deal with poor fuel some years ago, and been placed that a study of cause and effect in locomotive work was possible. As to the sizes of petticoat pipes, a mean between the two extremes, of very large and very small, was found under all circumstances to give quite as good results as either extreme.

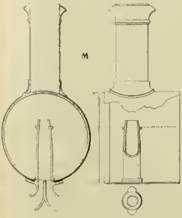

K

The telescopic device for adjusting the petticoat pipe to produce the best result was successfully used, enabling a control of the fire on all parts of the grates. Not all engines, however, could be worked with the parts in the same position. Each had to be tried, its fire watched and the parts adjusted until the fire burned with equal brightness in all places.


L

By the adjustments resulting from these studies and trials the steaming qualities of the engines in use were materially improved

Examinations of a lot of engines in which the sparks used to pile up in the smokebox and against the front, frequently taking fire and burning it out, showed an unequal draft through the flues—that through the lower ones always being deficient The knowledge gained by former observations applied here remedied the


M

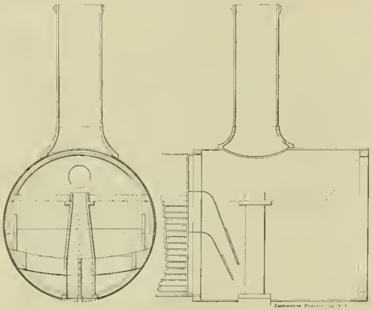
trouble, and much reduced the quantity of sparks gathered in the smokebox.

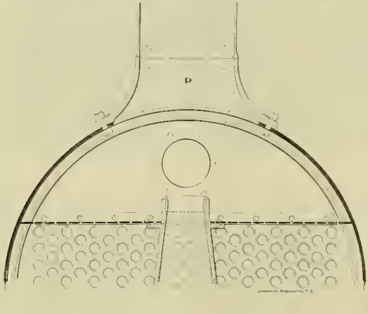
In later years the deflector plate has taken the place of the lift or petticoat pipe, to a great extent, and by it, especially when it is adjustable, as shown in Figs. A, L, M, N and O.

In some cases the writer has used two plates—the one controlling the lower half of the flues and the other the upper. The adjustable parts have been handled in the cab by levers, so that the draft could be regulated at will, but it is questionable if as good average results were reached as when the plates were carefully adjusted and then bolted in place

Whatever may have been the reason for extending the smokebox, as was done in 1859, it was after a time extended to have a place to catch sparks. It became fashionable, and very many roads used it for a while, then thinking it useless cut it off.

The writer's observations led him to conclude that the extended front end had another use, and a more important one than as a catcher of sparks. It was believed to act much as does an air chamber in connection with a pump and a column of water, viz Make possible a continuous movement of the water, notwithstanding the intermittent action of the pump




D

So the smokebox (as an air chamber) equalized the draft through the flues, and made it softer and more uniform than it would otherwise have been

Its uses enabled other changes which seemed to be in the right direction—softening and equalizing the draft and still making plenty of steam.

Now as to the nozzles. It will be noticed that all the earlier ones, especially the low ones, were double, as were some of the high ones. We also find that the sides of the nozzles (inside) were either parallel and intended to be vertical as in Fig. E, or they converged toward the top, as second figure on Figs. B, C, P, G, H, T, J and K, the convergence nearly always reducing the areas, and consequently causing a sharper or stronger jet (for it was a jet, and intended to be a jet), and

kept as solid and sharp as possible Fig L shows parallel sides, but a greater reduction of areas

It is true that to throw a solid stream of water a nozzle with parallel sides is required, and that the sharper the edges the better So it may be presumed that a solid stream of steam was wanted, and the sides should be parallel in the same way. Just why the converging sides were used it may be difficult to say, but probably to contract the nozzle and possibly hoping to further solidify the stream At any rate, the effect seemed to be to produce a jet, and pass it up as nearly as possible in the middle of the stack, and that it was done was shown by the way the cones were worn. The direction of the axis of the nozzle was intended to be central, but not unfrequently it hit the cones on one side, and sometimes, even one side of the stack

"Variable" nozzles have been used—intended to put into the hands of the engineers the power to increase the force of the exhaust and consequently of the draft. One case of this is shown in Fig. D, where the acorn shaped plug in the nozzle under the lift-pipe could be raised or lowered by the engineer, and thus reduce or enlarge the size of the exhaust opening Another case was where the nozzle was in two parts, hinged at lower side or edge, and arranged so the engineer could open or close it at will.

Dampers have been put in base of stack to lessen the draft on the fire by opening when desired.

As the variable exhausts have never come into anything like general use it may be presumed that their practical value was small.

The earlier uses of tall exhaust pipes would hardly be deemed a success, though after many trials it became so The earlier of the American experimenters probably tried to follow English practices, *without*


M

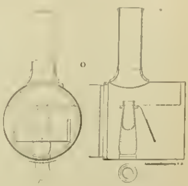
English conditions. The writer became convinced that they should succeed, and endeavored to ascertain why and how they failed.

He tried them with straight sides, with partitions, when single nozzles were used, very nearly to the top, and with practically no divisions, and finally settled down to a division about one-third the height. He


N

also tried the effect of various shapes, from the straight sides to quite large swells in the pipes, but finally found the best results from a shape practically shown by Fig. O, though in the course of his experiments he applied the principle to an old engine with exhaust openings at the sides of the smokebox, as shown in Fig N.

He believed it was a mistake to contract the nozzles and attempt to use a jet, but was convinced that a better result could be reached by making his exhaust stream *fill the stack and form a piston*. To this end he flared the top of the noz-


O

zles, as shown in Figs. M, N and O, and more perfectly shown in the large Fig P

With water, a nozzle shaped like this spreads the stream, and it was found to do the same with steam. The dotted lines from top of nozzle to bottom of stack show how it was intended to spread the stream and fill the stack. It will be noticed that the base of the stack is flared, is smooth and wide at bottom, the shell of smokebox being cut away to fit it.

This varies much from other practices, in which the stack base was square (see Figs. B, C, E, F, K, L, M), or extended down (see Fig. F), or shell not cut away (see Fig. J).

The chamber formed by the swelling of the exhaust-pipe, and the filling of the stack at its base, and the use of the steam as a piston has been found to render possible a reduction in size of stack, and an enlarging of the nozzles, until on a 20 x 24 consolidation engine the writer uses a 6-in. diameter nozzle, and the engines steam well and are economical in fuel.

The draft is so softened that there have been engines run for months, without any netting in, and they did not throw fire.

A great deal has been written about back pressure with single nozzles, and undoubtedly truthfully with the engines considered in the papers written, for the nozzles were on the jet principle and very small compared with what is possible to-day. The single nozzle was condemned, and the condemnation was broad and covered *all* single nozzles. Nevertheless, it still exists, and the author of the articles referred to is now using them, notwithstanding his former condemnation.

The writer's examination showed that a smooth stack (on the inside) is very desirable, and that even a rivet head on the side is an obstruction and should be avoided. The cylinder of the stack may be of cast iron or sheet steel. The latter is lighter, but if used rivets should be countersunk. The base should flare as shown in Fig. P, and barrel of smokebox should be cut out as large as possible. Then, with a nozzle that fills the pipe, and with steam forming a piston, you have, with the proper adjustment of the deflector, as good a device as is now in use—permitting, as it does, the use of a very large nozzle (6 inches diameter for a 20-inch engine), giving a very soft exhaust and still steaming freely.

A comparison of the work of the engines so treated, when made with those of other roads of like character, as to engines, grades and business, but with better coal, shows markedly in favor of the engines described.

Comparative statement of average coal per car mile, several years, used by engines the writer refers to.

	Lbs.
Freight (writer's engines)	2.51
Other roads	4.40
Improvement	1.89
Passenger (writer's engines)	12.00
Other roads	14.00
Improvement	2.00

This sustains the writer in the belief that the exhaust-pipe with swelled body, and curved line in nozzles, that fill the stack and give piston action, are superior not only to the double nozzle, but also to the exhausts as in common use, and shown in most of the sketches.

It should be borne in mind that the writer's experiments with the exhaust-pipe nozzles commenced in 1883, prior to which time it is believed that no one had used the nozzle with curved lines, thus giving the piston principle, or had used the swelled body of the exhaust-pipes, or had in any way succeeded in using so large nozzles, and thus softening and equalizing the draft upon the fire.

It has been the writer's pleasure for a number of years to explain his experiences to many of his brother mechanical officers, and in the last five or six years he has sent drawings of his pipes, or the pipes themselves, to quite a number of them, and was glad to know that considerable interest was taken upon the subject.

In the discussions of the Master Mechanics' Association it evidently had taken a place, for in 1890 a special committee was appointed to consider the matter. In the report of the meeting of 1891 we find quite an elaborate report from this special committee upon the subject of exhaust-pipes. The examinations, however, seem to have only partially covered the ground, notwithstanding the fact that one member of the committee had served under the writer, and was to some extent familiar with his experiences.

Their observations seem to have been centered upon the form of exhaust-pipes, and their experiments on this line are of value but had other and quite as important matters been considered at the same time, their value would have been increased.

The form from which they seem to have gotten the best results was not unlike those selected by the writer, and from which their investigations seem originally to have started. It will be noticed, however, that the nozzles which they used all had either parallel or converging sides, and in one of the nozzles tried the areas were reduced substantially as shown in Fig. L.

The committee evidently used and wished to use the jet system and solid central stream, and they gave it in their report as their opinion "that when a pipe is of such shape as to insure *central* and *solid* (the italics are mine) discharge the best results will be had," etc. They say, also, "where care is not taken to insure a *straight* discharge, part of it impinges *against the sides* of the stack (italics mine) with injurious results to the steaming." The inference you may draw from this last remark is that their aim was to get the "jet" through the stack, practically without touching the sides.

They conclude by showing a preference to the taper stack.

It is the experience of the writer that using the piston principle with the large nozzles and straight stack, as he used it, better results have been obtained.

The committee used no nozzle in their experiments on consolidation engines larger than 5 inches in diameter, which has an area of 19.4 square inches, while the writer is using nozzles 6 inches in diameter, with an area of 28.27 square inches, or 45 per cent greater than the 5-inch nozzle.

In these days of progress it is quite possible, or perhaps the better word would be probable, that some better arrangement will be found in the near future, and when presented, the writer will gladly welcome it—but up to the present, his best results have been obtained with the swelled exhaust pipes, flared or curved nozzle, and straight parallel-sided smokestack, giving piston action, and with the bottom of stack flared and smooth, substantially as shown in Fig. P.

COMPLIMENTS OF THE SEASON. COWICHAN RIVER BRIDGE, E. & N. RAILWAY, BRITISH COLUMBIA, RIVER SPAN 275 FEET LONG.

A Vermonter of the Good Old Time.

In a letter to his old home in Vermont, nearly a year ago now, Mr. Benjamin Garvin, of Fond du Lac, Wis., said:

"I read in *The Messenger* an account of old time-tables of the Vermont Central. I was an engineer on the road and ran the first train to Northfield and Windsor in the fall of 1848, to Montpelier in June, 1849. The road was opened to Winooski in the fall of 1849. When the road was opened to Waterbury we made the run from White River, or rather from West Lebanon, N. H., about 77 miles, inside of eighty minutes, and made two stops, with engine 'Ethan Allen,' which had a 5 ft. 6 in. wheel. John Danforth and I ran it in the fall of 1850. We ran to Rouse's Point in the fall of 1852 and I ran from Essex Junction to the Ogdensburg depot and boat house, across the lake, think it is 48½ miles, making nine stops, in 65 minutes, left Essex Junction at 6:15, stopped in Ogdensburg boat house at 7:20. Danforth ran from Northfield to Essex Junction, going into Montpelier and backing out, making 47 miles, with nine stops, in fifty-two minutes. H. Campbell was superintendent, and he timed him and told me that he did it in fifty-two minutes. We commenced running express trains from Ogdensburg and Montreal May 1, 1853. I saw Marvin Brown in Chicago last week, he was the first engineer on the Ogdensburg line running from Ogdensburg to Rouse's Point, 118 miles, with four stops, took wood and water twice, and did it in 140 minutes. I made the run from Rouse's Point to Burlington, making five stops, in seventy minutes; from Essex Junction to Northfield, 44 miles, in fifty-three minutes, and from White River Junction to Northfield, 55 miles, in sixty-five minutes, making five stops. Do they beat it now on a good track? I guess not. I would like one of the old time-tables. I was seventy years old October 2, 1893, and am hearty and well. I came to Chicago in April, 1854, and helped build the C. & N. W. Railroad from Chicago to Lake Superior. I am not on the road now, but am as well as ever. Marvin Brown is running on the St. Paul road out of Chicago."

Sheep and Wolves.

We have received a number of letters from enginemen, especially in the South, inclosing glowing circulars from a Wall Street firm of brokers, so called, soliciting the use of $50, $100 or $500, in a "combination," for stock gambling. Some of our readers ask us to find out if they are "all right." Boys, use a little of the hard, old common sense in your heads. If these fellows can double up your money so fast, they can double up their own and could become rich in a very short time on "the street." Wall Street sharks do not eat one another, they feed on "lambs" from the rural districts—don't be a lamb. The longer you live the more you will see the truth of the old saying, "you can't get *something* for *nothing*." In the long run a man gets just about what he pays for, and no more. The Wall Street philanthropists who advertise to give away fortunes, great or small, to unknown railroaders up in Wisconsin or down in Alabama, and who don't care for any such snaps for themselves, are good people to keep away from.

Two Railroad Views in British Columbia.

We are indebted to Mr. Toney Silvine, an engineer on the Esquimalt & Nanimo Railroad, on Vancouver Island, B. C., for the photos reproduced here.

One view shows Mr. Silvine's engine with a K. of P. excursion train on a very high and crooked trestle bridge—225 feet above the stream. This road has many of these. The other view shows how a little melted snow knocks out a 275-foot span bridge when it starts out to make spring calls.

A Few Yards of Red Tape.

The whole general official force of a well known road were out on a tour of inspection. At each division they would pick up the division officers, and take them over their own part of the line.

The special was on the siding waiting for No. 6. A section gang were at work near by, and No. 6 was late.

The crowd stood on the track waiting and talking.

The general manager squinted down the main line, and said to the general superintendent, "John, ain't there a low place in the track there?"

John squinted.

"Smith," said he to the division superintendent, "there's a low joint there at that switch."

Smith squinted.

"Hogan," said he to the roadmaster, "there's a bad joint there, better have it fixed."

Hogan squinted.

"Sullivan," said he to the section foreman, "there's a dam bad joint there; raise it up."

Sullivan squinted.

"Jerry," said he to one of his gang, "Phy in the divel don't ye do phwat ye'r tould, go ye now and tamp that low jint."

Jerry squinted—but he got his bar first.

"Moike," said he to the youngest man on the job, "dom youre lazy sowl, do yez come and tamp this toie phwile Oi hould upp the ind."

"Moike" failed to squint.

And, lo, the low "jint" was raised.

They Did Go Around.

"A long time ago," remarked Fred. Casey, of the Ashton Valve Co., "when I was running on the Lake Shore, the tramps were pretty thick, and got to be something of a nuisance.

"One chilly night I put one fellow off the pilot, and then off the back of the tank, but at the next water station the fireman told me he was on the front end of the baggage car.

"We had a small hose, connected to the pump pipe, for wetting down the deck, and I laid its nozzle on the clothes box, put a stick of wood on it, and turned the pet cock—it just threw a nice steady spray of cold water over the rear of the tank.

"We had a piece of pretty crooked track around and among some little lakes, the time was lively, and I forgot all about my tramp.

"I got down to oil at the next station, and the wettest looking mortal I ever saw came up to me and said in the dryest way

"'Say, pardner, I allus thought this road went around that lake—damme if ever I knowed before that it went *through* it'

"I told the poor cuss to get right up by the firebox and get dry—and I carried him to the end of the run."

A Rusty Fortune.

Those of our readers who remember their history lessons will perhaps recall that long years ago early in the eighteenth century, probably about 1715, the French Government built a great fortress on the Island of Cape Breton, now the extreme eastern part of Nova Scotia.

This fortress was the strongest in the New World, and was called the Gibraltar of America. It was the stronghold of the French, then chronically at war with Great Britain and the colonies, and was the refuge of several hundred privateer vessels that continually ravaged the American fisheries.

The colony of Massachusetts proposed to reduce it, and being joined by other colonies, 3,500 men were sent against it, sailing from Boston in 1745, and shortly after captured the fortress. It was afterwards in the hands of the French by treaty, and was again reduced in 1758. But to our story.

On this fortress were mounted thirty large cannon and many mortars, and on a sixty-four-gun ship in the harbor, also captured, were many more heavy guns. Before the surrender the French spiked many of these guns and threw them into the sea.

Along about 1876 some enterprising man up there conceived the idea of raising those guns for the old metal in them, and some fifty or sixty rusty old cannon were soon lying on the dock awaiting a purchaser.

But the rust on the guns commenced to bulge out and scale off inches deep, and a hammer or hatchet could be used to cut the corroded metal as if it were green cheese, and the junkmen refused to make an offer.

It was finally decided to sell the whole at auction, and it so happened that on the day of the sale Mr. William P. Tyler, now president of the Tyler Tube and Pipe Company, at Washington, Pa., and then a buyer of iron, old and new, dropped into town.

When Mr Tyler showed up at the sale, the auctioneer, whom he knew, spotted him and asked him to bid, but Mr. Tyler looked at the rust scales and declined.

Being pressed to "start 'em at something," he offered two dollars each for the guns, and, after the usual harangue and "last calls," "going, going, *gone!*" was shouted, Mr. Tyler owned several car loads of rusty cast-iron guns that he did not want.

Shortly after the purchase, an old lady in the crowd came to Mr. Tyler and asked him if he was the man that bought the guns, and when the victim acknowledged that he was, she exclaimed

"Why, sir, your fortune is made. It's a tradition here, and I know it from my own family, that when the French officers found that they must surrender, they collected all their watches, diamonds, jewelry, etc., put them into one or more of these guns, rammed a solid shot on top and dumped it overboard."

It seemed like a not altogether improbable story, and Mr Tyler commenced to look for a gun with a shot in it. One was soon found with a rusty ball not far from the muzzle—which lent color to the story.

Mechanics were sent for with chisels and hammers and ordered to cut that gun in two, just back of the shot.

It was the work of a few moments to cut through two or three inches of rust, it crumbled out like red brick, and was eagerly gobbled up for keepsakes by the bystanders. It was not long, however, before the workmen came down to good iron, and the chipping was hard work, but in time the muzzle of the gun was knocked off by a blow, and there was the gold—in the old lady's mind.

Back of the shot was a dark cake of rust, the base of which had probably once been powder, and that was all.

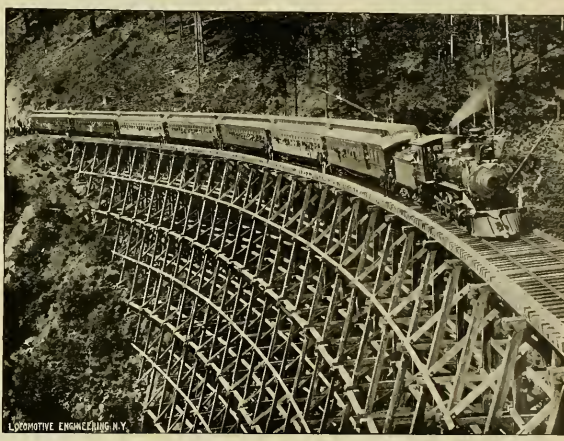
About this time one of the curiosity-hunters came to Mr. Tyler and said his specimen was hot, and so it was. All the chips of rusty iron were hot, the action of the air on the oxidized iron was causing some change that produced heat.

But none of these things, however interesting, made the bargain any better except the fact that there was *some* iron left in the guns. They were shipped to Boston anyway, and an analysis showed that the iron left was the quintessence of refined charcoal iron, finer than anything on the market—refined by some process of nature in 130 years' of immersion under the sea.

Mr. Tyler sold these guns for $60 per ton, and realized a profit of more than $6,000 on the deal.

A New Smoke Consumer.

A smoke preventing locomotive designed by Mr. Theodore Langer, a German engineer, has been giving very good service on the Northwestern Railway of Prussia. A newspaper notice of the invention says "After years of observation Mr Langer succeeded in explaining with theoretical correctness the complicated processes of heat power and the law of the composition of smoke. In harmony with this law he placed outside the boiler an automatic device which supplies the fire with just enough air to make possible the consumption of the smoke and gas. In the space over the fire a steam veil operates in such a manner that the air and the gas are whirled together and thoroughly mixed. The gas which has thus been burned is then forced against the boiler and its heat-giving power is utilized to the last possibility. The great advantages of this process are plain. Besides effecting a great saving of heating materials—estimated as 10 to 25 per cent.—it enables a railway company to do away with the disagreeable and unhealthy smoke, cinders and gas which are emitted by locomotives of the usual type. for the locomotives provided with the Langer smoke-consuming device give out only the pure steam necessary to operate them. . . . This device has been applied on thirty-five locomotives (most of them in the express train service) of the Northwest Railway, and after trials extending over two years has been found in every way satisfactory. More locomotives are provided with it by the Northwest company almost every month. Other companies which have tested the invention report equally good results.



In Arbutus Cañon, British Columbia—Bridge 225 Feet High, on Esquimalt & Nanimo Railway.

Searching for the Best Metal for Brake-Shoes.

A number of railroad companies are making systematic tests of brake-shoes to find out what material combines the highest frictional resistance with the greatest durability. It is a question badly in need of settlement. The first requisite of a brake-shoe, of course, is good holding qualities. Soft cast iron appears best to fill this requirement, but shoes of this character wear so rapidly that they will not last over a single long trip where much braking has to be done.

If the tests which the railroads are engaged in will lead to the selection of a metal which gives fair holding power with durability, it will render the brakes much more efficient, for the common soft shoe frequently causes the brakes to be inoperative toward the end of a journey.

In the tests in operation, thirteen special brake-shoes are under trial. One truck is equipped with soft cast iron shoes, made at Altoona, of a known hardness, and the other truck is supplied with a set of special shoes. Close records are being taken, and conclusive information will soon be forthcoming.

Special Shop Tools on the Union Pacific.

In the discussion at the Master Mechanics' convention on "Special Shop Tools" Mr. J. H. McConnell said:

"We have a great many tools in our shops that are driven by compressed air. The use of compressed air has entered very largely into the use of different tools. We find that we make a great many very [illegible] and valuable tools. For instance, [illegible] number of pneumatic lifts through the shops that are made of common gas pipe, the parts put in the lathe, and [illegible] a wrought iron die with a driving fit [illegible] through with a hydraulic press to [illegible] it upon the inside, and then use a [illegible] similar to the Westinghouse with a [illegible] packing. We use these lifts over [illegible] and cylinder boring machine [illegible] have one over every driving wheel [illegible]. We [illegible] have another arrangement [illegible] them in the center, and on taking [illegible] of the lathe the same arrange[illegible] them out. We have in the [illegible] Moffatt drills. They [illegible] by air. We tap out our [illegible] the staybolts in and [illegible]. We have a number [illegible] in the way of grinders [illegible] that we drive by compressed [illegible] small tools. They [illegible] a fan, and the [illegible] with an exhaust [illegible] on a [illegible] inch emery [illegible] speed of about [illegible]. That is suit[illegible] grinding [illegible] and other small [illegible]. We have about [illegible] that are driven [illegible] around the [illegible]. We also [illegible] when [illegible] engine. We [illegible] especially for [illegible] also jack up [illegible].

We [illegible] driven by air [illegible] of the [illegible] from the [illegible] car, put on the [illegible] get a finish on [illegible] hand except by [illegible]. I would [illegible] that three sheets of [illegible] will go [illegible] the side of a car [illegible] sheets of sandpaper will sand[illegible] the whole surface of the car with [illegible] arrangement. When our engines are [illegible] to blow out, we blow the passages [illegible] fill the boiler with air and blow out the [illegible] passages, fill the boiler with air again [illegible] the engine into the round house.

We have got a number of special tools [illegible] different design — some that we have made and some that we have bought, that are very useful to us. I want to say that the coming tools for use in machine shops are going to be driven by air. We have a plant and are using three air compressors. We have two miles of pipe in our yard. It is all through the car shop, all through the machine shop, all through the boiler shop. We also have it in the foundry. We use it for taking up the iron and coke to the cupola, and wherever we can locate a [illegible] in the yard for convenient use we drive that by air."

Much Ado About Nothing.

"Indelible pencils" does not constitute a subject which the ordinary man would suppose to be of absorbing interest to railroad men, but it is wonderful the amount of talk we have heard upon it within two months. At a railroad club meeting we listened to an impassioned plea of nearly an hour's duration in favor of the retention of the indelible pencil as a tool of the car inspector. The appeal reminded us of an incident that happened in Scotland when new sanitary laws called for the removal of all dunghills from the doors of dwellings. An old woman had refused to move her midden as the malodorous manure heap is called, and a force of men were sent to remove it. The owner squatted herself on the heap and tragically exclaimed, "You may murder me and trample me into the earth, but you can only remove the midden over my dead body." The appeals for the retention of the indelible pencil were repeated at great length and with earnest fervor at the M. C. B. Convention, and some of them were as sensible as the wail of the old woman against the removal of her midden.

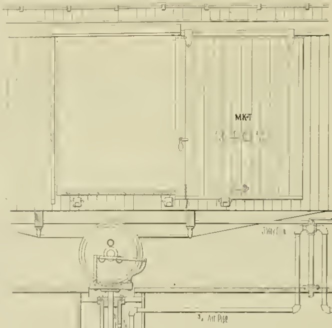
Locomotive Engineering Problems That Could be Solved by Shop Tests.

A great deal has been said during the last two years in railroad club meetings, master mechanics' conventions, and by the engineering press on the necessity of carrying out shop tests of locomotives for the purpose of finding out things that road tests have never demonstrated with any accuracy.

The authorities of Purdue University equipped a laboratory with a locomotive that could be run on rollers at speeds approaching those obtained in ordinary service. The information obtained by this apparatus was of such an interesting character that the Master Mechanics' Association moved at their convention a year ago to have exhaustive tests made at Purdue University. The work of raising funds for carrying on the tests was assigned to the secretary, Angus Sinclair. In appealing to railroad presidents for the necessary assistance, a letter was sent out which gives a comprehensive account of the engineering problems that might be settled by shop tests. The letter said:

"There are a great many problems relating to the locomotive that seriously affect the economy of its operation, which remain unsettled because the tests of service are made under such varying conditions that nothing is settled by them. Compound locomotives have been in use for the last twenty years, but it is still a disputed question whether or not they are economical in service as compared with simple engines, and for what species of service they are best adapted. Steam engineers say that serious heat losses result from the prevailing practice of running locomotives with the steam throttled, but the real facts of the case have never been thoroughly settled. It is undoubtedly a fact that some locomotives can be run more economically with restricted steam admission than with the throttle wide open, while others are quite the reverse. Why such conflicting conditions exist can only be settled by accurate shop tests. There is uncertainty as to what grate area in proportion to heating surface is productive of the most economical results. There is much conflict of opinion concerning the value of feed-water heaters; about the proper weight for counterbalancing the reciprocating parts, and numerous other things are subjects of controversy which ought to be known with certainty. Nearly all similar problems relating to stationary and marine engines have been settled, because tests could be made that were subject to the same conditions every time they were carried out. This treatment has been impracticable with locomotives, because the weather, the condition of the track and the varying conditions of trains are never the same two days in succession.

"The members of the American Railway Master Mechanics' Association feel that great waste of fuel could be prevented, and a reduction in the cost of repairs effected, if properly conducted shop tests were made, and that railroad companies would be substantial gainers therefrom."



Car Wheel Loader, M., K. & T. Ry.

One More Safety Angle Valve.

The angle valve shown takes care of the train pipe and the signal pipe as well—sort of a twin. One valve cannot be opened or closed without opening or closing the other.

The passages *A A* are the openings of the signal-pipe cock, those marked *CC*, the openings of the train-pipe cock.

Groove *E* is designed to catch any leak that might occur along the plug and pass it out of the small hole *h* in the case. *K* is a second hole in the shell so placed that if the cock is turned as much as one-eighth of the way, air will escape through it and cause the signal whistle to sound.

In the plug there are also two small holes *g g*, that also allow air to escape through port *k* when plug is entirely turned or shut off, so that it is impossible to close, or partially close, the train-pipe plug without causing a leak in the signal pipe and lowering the pressure there.

The designer requires that there be a shut-off valve in the signal pipe in cab, below the whistle, and that there be a small gauge attached below said shut-off cock.

Should a brakeman fail to open all angle valves properly, the engineer can see it by the gauge, and by opening the shut-off cock by the whistle, that there is something wrong with the cocks. And the engineer could always tell when there was anything wrong by the gauge.

On rear of train a tight dummy coupling is necessary, and the angle cock is run open—to prevent escape of air through port *K*.

There seems to be no good reason why this cock would not accomplish all that is desired. The question is to be solved in one of two ways: 1st. A cock that sets the brake if turned or partially turned off. 2d. A cock that warns the engineer that his air is cut out, but does not set the brake. This cock is of the latter class, and is a good one of its kind, although the editors confess to a preference for the first class.

The inventor of this device is Mr. Wm. Crawford, of Winnipeg, Manitoba.

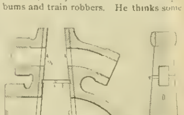
Compressed Air Device for Loading Car Wheels.

The compressed air jack here shown is in use at the M., K. & T. shops, at Dennison, Tex., and is a simple means of doing hard work easily, expeditiously and cheaply. No detailed description is necessary; anyone who can see will know from the engraving just how the apparatus works. The jack is set close enough beside the track to bring a wheel resting on the top just on the door of a box car or top of a flat. The wheel rests in a depression in the wooden cap of the piston rod and again on an iron frame. When it is lifted it is in position to be rolled to its place on the car.

The loader is a great help in giving a "boost" to other heavy pieces of freight if they are but placed over it.

A Hot Water Cure.

Mr. F. A. Whitney, secretary and treasurer of the Des Moines Rapids Towing Co., writes us, suggesting that a perforated pipe be fastened across the rear of the tender and connected by a T and suitable piping to the boiler, so that the engineer could, by opening a valve, make that point of vantage very uncomfortable for tramps, bums and train robbers. He thinks some robber-infested road should try it, and let the world know how it works. It would surely scatter anything and everything on the front platform of the "blind baggage"—but this reminds us—what's the earthly use of the blind baggage platform, or any platform, on mail, express or baggage cars? The L. & N. have solved that problem, and solved it right—by making such cars without platforms at all.

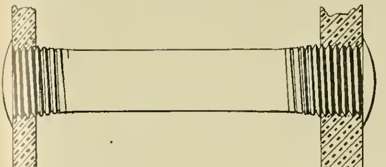

Twin Angle Cock.

The detectives of a certain road were recently put out on the road to capture tramps who were continually shutting off angle cocks on certain passenger trains. They watched and rode for two months but found no tramps on trains where angle valves are tampered with. One detective, who didn't know any better, sat on the platform and watched the angle valves half a trip—and caught the offender. The valves were closed by the swinging of the safety chains, which were left uncoupled.

Broken Stay-Bolts—Cause and Effect.

BY CHAS. F. FOURNESS.

This is a subject upon which a great deal can be written. *Cause and effect*—the effect is very easy to comprehend, as, for instance, broken or corroded stay-bolts are found, that is the effect—find the cause. The principal cause or reason for stay-bolts breaking is on account of the difference in the expansion of the firebox and the shell inclosing it. And most of the broken bolts are found in the top rows,



although a great many are found at the offsets on the side sheets. I, in one case, removed over twenty bolts along the rows at the offset on one side of an engine in the shop, although the stay-bolts are tested on all the engines every three months. Also, at times many are found at the bottom corners. These are not found broken so often as the upper ones, as the firebox starts to expand from the mud ring, and so does not bend the bolts so much. I must say it is the exception rather than the rule to find any number broken here. When the fire is first started in the firebox to get up steam, in particular when the fire is forced, when steam is wanted in a hurry. I know of cases where a pipe was ran from another engine with steam up, and put up in the jack at the top of the smokestack to use as a blower. Steam can be raised in a very short time that way, but how about the boiler and the stay-bolts? Just imagine how that firebox must expand, as the outside is comparatively cold, perhaps dead cold besides the firebox being so much thinner. And certainly when the fire-box expands more than the outside the bolts bend, and when they have been bent to the limit of their endurance they break, and the better the quality of the material in the bolts the longer they will last under the bending action. These bolts do not break clear off at once, of course, as any number are found partly broken. And the engines that carry the highest pressures have the most broken. In one case in particular, on a 180-pound engine when giving her a new firebox we found

Thirty-six stay-bolts partly broken off on the back sheet.

Twenty-eight stay-bolts partly broken off on the throat sheet.

Seventy-one stay-bolts partly broken off on the back right side sheet.

Thirty-two stay-bolts partly broken off on the left side sheet.

This will give 167 stay-bolts partly broken that we noticed, and we also found three bolts broken clear off on the right side and two broken clear off on the left side sheet. At the offsets, this short arc of a circle which changes the circle to the flat sides on the outside sheet, this is exposed to the pressure on its convex surface which tends to straighten out. Here the stay-bolts must be exposed to considerable of a strain if the stay-bolts are placed to pull straight, as they should, when the firebox expands it pulls up on these bolts in its endeavor to pull in the outside sheet, which it is unable to do to any extent. The bolts on the straight part of the sides are free from this, as they are only subject to the bending action, and the longer the bolt the less the bend. I once read a letter in a mechanical paper. This letter was written by a master mechanic on broken stay-bolts, and he claimed that they were caused mostly by the stay-bolts being put in loose, that if they were put in a nice snug fit they seldom broke. I claim he is altogether wrong.

A stay-bolt, if it is a nice fit and can be screwed in with the hand, is tight enough, and never tighter than to require a 6-inch wrench—it will give the best service. I have known bolts to be put in that could be shook around in the holes and never gave any trouble after being well hammered up. I fail to see why, if a stay bolt is screwed tight in the hole in the firebox sheet and then hammered up, that it does not produce such a heavy strain on the sheet as to cause the sheet to crack out from the holes. But to the point as to the greater liability of a loose bolt to break over a tight one. Every one with any experience in this matter knows that the stay-bolts invariably break on the outside close to the sheet. I have never known of but one to break next to the firebox, the reason they break on the outside is on account of the outside sheet being heavier, it being at least one-half inch thick, while the firebox is usually but five-sixteenths. When the firebox expands and bends the bolts they are held like a vise in the outside sheet, especially when a tight fit, and they bend close to that sheet causing them to break at that point, while the firebox being lighter the bolt is stiffer than the sheet and the sheet springs. I have noticed in some cases, after the stay-bolts were removed from the outside sheet that the sediment (it just showed white) had formed between the stay-bolt and the sheet in the hole to within about three-sixteenths of an inch of the outside, showing that that was the distance back the stay-bolt was upset. Why would that not be easier on the bolt when subject to the bending strain, as the bolt has little play in the hole on the inside, while on the outside the bolt would be held firm for three-sixteenths of an inch. The bolt not being held so firm would bend to a longer radius (not bend so short), consequently would not be so hard upon the latter. And also if the stay-bolts were reduced in diameter to just below the thread in the water space between the sheets (see sketch attached), this would leave the bolt the strongest next to the sheets and weakest between and away from the sheets, so in bending the bolt would bend very nearly its whole length to a longer radius, and would be ever so much easier on the bolt and would have no thread at the bottom of which to start a crack. As the strength of a stay-bolt is figured from the bottom of the thread, and it is seldom that the strength of the stay-bolt is not in excess of the strength required, they can be reduced without any loss or increase in the size of the bolts. A great many will hesitate at the cost of turning, but where in the neighborhood of 70 broken bolts are found each test, I think it would pay.

Some time ago I had orders to prepare some samples to test and see what, if any, difference there would be between a stay-bolt screwed tight and a bolt screwed quite loose in the hole. The results of these tests were as follows:

STAY-BOLT TESTS.

	Sample	Tons	Sample	Tons	Sample	Tons	Av'age
7/8-inch bolt screwed tight in 7/16-inch firebox steel.	1st	12	2d	9½	....		10.75
7/8-inch bolt screwed loose in 7/16-inch firebox steel.	1st	8	2d	9	3d		8.50
7/8-inch bolt screwed loose in 5/16-inch firebox steel.	1st	4½	2d	3	3d	5	4.16
7/8-inch bolt screwed tight in 5/16-inch firebox steel.	1st	9	2d	10	3d	8½	9.16
7/8-inch bolt screwed tight in 5/16-inch firebox steel (this bolt hammered).	1st	10½	2d	11	3d	10½	10.66
7/8-inch bolt screwed loose in 5/16-inch firebox steel (this bolt hammered).	1st	12	2d	10	3d	10½	10.83

We had two samples of each with sheet 7/16-inch thick and three of each with 5/16-inch sheet.

By this you will notice that while the average of the loose bolt unhammered was lower, the loose bolt hammered gave the best average.

CORRODED STAY-BOLTS.

Corroded stay-bolts are seldom found; they are caused principally by the boiler lying idle with water in it, and, of course, some waters have impurities in them, the use of which causes corrosion. I have some samples here of stay-bolts removed from a stationary boiler that had been in an elevator, and the stay-bolts were reduced from three quarter inches in diameter to one-half inch in thickness. This boiler had been out of use a great deal and the water left standing in it.

Water Flashing Into Steam.

In the course of a discussion at the Southern and Southwestern Railway Club on "Fusible Plugs for Fireboxes," Mr R. P. C. Sanderson, of the Norfolk & Western, mentioned a fact in connection with the law which keeps water liquid under certain pressures, which has very rarely been seen in practice. It is well known, for instance, that while water turns into steam at a temperature of 212 degrees under atmospheric pressure, it will stand a temperature of 350 degrees before turning into steam when the pressure is 120 pounds to the square inch. These figures are a matter of calculation, and are rarely seen in operation except in laboratory experiments. In the remarks made by Mr. Sanderson he said: "I never appreciated the fact as to water flashing into steam until I watched it, when trying to wash the grease off engines with hot water, and found we had nothing but steam a few inches from the nozzle, and we had to get pressure down below 100 pounds before there was any hot water when the jet struck the grease."

In connection with this engineers understand how much more disastrous a boiler explosion is when a large quantity of water has been in the boiler than where the boiler supply was short. Those who have given the subject most attention are well aware that a boiler carrying a large volume of water is much more liable to disaster, in case of anything happening, to suddenly reduce the pressure on the boiler, such as the fracture of a sheet or the sudden opening of a very large safety-valve. When the sudden reduction of pressure takes place the water flashes into steam, and there have no doubt been many cases where this has caused violent boiler explosions.

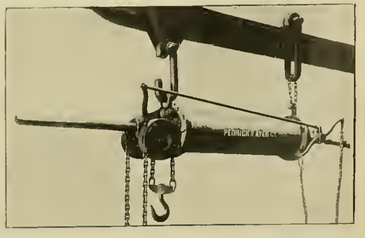
Application of Air to Chain Hoist.

The accompanying illustration shows the ingenious method of applying a pneumatic cylinder to a differential chain hoist, recently patented by Mr. Howard Pedrick, general foreman of the Pedrick & Ayer Co.'s shops, at Philadelphia.

As will be seen, the cylinder is the usual arrangement, except that the lower part of the piston rod is a heavy rack. This rack engages with the teeth of a forged gear wheel; on each end of the gear wheel shaft there is a sprocket wheel carrying the usual chain.

The difference between the gear wheel and sprockets governs the length of hoist for a given movement of piston.

This hoist automatically retains the load at any desired height regardless of the air pressure, this is done by a pawl that engages the rack on the piston. This pawl can be operated only by the air-valve cock—it is disengaged when the pressure is on, or the valve is open, but once closed it is locked into engagement and can not be released except by opening the valve again. It will be readily seen that should all the air leak off, the load would be secure.



AUTOMATIC LOAD-SUSTAINING AIR HOIST.

This hoist is particularly applicable to jib arms, and other places where it is desirable to get considerable lift in short space. The crane shown lifts 6 feet where there is but 8 feet head room.

There are no stuffing boxes to keep up and no ropes to tie or wheels to block.

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The Difference Between Wholesale and Retail Train Robbers and Railroad Wreckers.

In most of the States there are laws meting out severe punishment to train robbers and railroad wreckers, and law or no law, public opinion excuses the exercise of lynch law when the offenders are caught red handed. But all this is for the cheap, poor, miserable robber or wrecker who only tackles one train at a time, him of the bedpale, the mask and the six-shooter.

There are stringent laws against the *retail* robber and wrecker, the *wholesaler* is protected by laws, and his honor and glory among his fellow men is only governed by the measure of his success—the size of his bag of plunder.

The press and the public have been sweating blood, and many good citizens have predicted the destruction of the Republic because the mobs destroyed a few hundred cars during the recent disastrous strikes. The mobs destroyed, perhaps, a million dollars' worth of property. On one railroad alone, at the same time, a president and his officers falsified the accounts over *seven* millions and was at the time a receiver of the property, under the protection of the United States courts.

Our laws favor dishonest management of railroad properties—else how could such men as McLeod put his presidential hand into the Reading Railroad treasury to the tune of $3,000,000, without suffering the punishment of other robbers.

The president of the Santa Fé, Mr. Rheinhart, a receiver of the company, caused a loss of millions to appear as something else to deceive investors. His only punishment has been the necessity of resigning his position.

The facts of the matter are that most roads (there are some exceptions, of course) are managed by men who have no ownership interests in the matter, and are often—nay, usually—the enemies of the property, treating it just as a privateer does a captured prize, to be looted at leisure.

It is to the interest of every American citizen, more especially those employed by railroad companies, that our railroads should be well and honestly managed, that there should be constant development of the systems, and that the hampering legislation known as Granger laws, be stopped, and those already on the statute books be repealed. The people mistake the railroad company for the management—they are two distinct and separate things.

Laws like those in Texas, for instance, check railroad development (just what Texas needs), and increases the chances of gambling in Texas railroad securities. It is just as easy to make money on the "short" side of stocks as on the "long", to bet that pending legislation will make stocks cheaper, as to bet that the building of new lines will make it of more value.

A bill has recently been introduced in Congress that is intended to reduce these wholesale robbers from the ranks of archangels to common criminals, and if adopted as now worded, looks as if it might do something for the benefit of railroad security holders, railroad property and railroad employés.

Among other things, it declares criminal all violations of trust in the management of railroad properties engaged in inter-state traffic, such as selling securities "short," or the purchase or sale of subsidiary properties for personal benefit.

Many a railroad has paid its own officers ten times the value of a "feeder" that the road did not need or want.

The bill seeks to insure honest elections of railroad officers by crushing out the "proxy" fraud—requiring every voter to declare on oath that he or she is the *bona fide* owner of the stock voted—it is customary now for officials in power to put their hands into the treasury and put up "margins" on stock, so as to get temporary possession of it to vote themselves into power again.

Every thinking citizen has before this recognized the fact that railroads are *not* private corporations, but *public* ones, whose operation affects all classes of people just the same as the functions of the postal system does, only on a greater scale. They perform public service on franchises granted by the public. This bill provides that there shall be government inspectors of railroad accounts—just as there are now government inspectors of banks, who shall make public correct reports of conditions, resources, etc., of all railroads. This for the security of investors and the public.

The bill also makes a wise provision that prevents its own courts from appointing as receivers the very men whose mismanagement have caused the receivership.

Not the least important provision of the bill is that one which requires the initiative in the prosecution of wrong-doers in railroad management to be taken by the public prosecuting authorities, just as it now does for those who commit crimes against National banks. When defenseless stockholders attempt to draw the law's attention to the official criminal who has robbed them, they have their trouble and expense for their pay. When the Grand Jury and the prosecuting attorney have to take up these cases and the punishment is fixed, as this bill does fix it, at not less than $5,000 and not more than $20,000 fine, or a term not less than one year nor more than five in the penitentiary, or both fine and imprisonment, it will be different. Criminally dishonest managers will be less bold, and there may come a time when railroad stocks will be good and safe property to own.

The bill seems to lack one essential point, and that is in fixing the responsibility of directors. In the Reading, Atchison and Northern Pacific scandals many directors have assumed that their skirts were cleared when they announced that they "knew nothing of the acts of the operating officers." Directors should direct, and a provision should be made in the new law fixing their responsibility. Hundreds of thousands of dollars are yearly invested in railroad securities because investors know this or that director to be a good man.

Many interested parties will object to this bill becoming a law, offering as an excuse that it interferes with private rights, but it does not, it only seeks to enforce honest methods in handling the greatest and best investment of money in the country, to prevent highway robbery and railroad wrecking. The honest railroad manager has no more to fear from this law than the law against robbing hen roosts. Only those who fear the light of day to shine on their methods will lift up their voices and smite upon their breasts.

Half of the reductions of wages of the operatives of our roads has been the last squirm of such managements, or their successors, and an attempt to take out of the necessary expense of operation money to cover the shortage caused by manipulation.

With a ten thousand dollar-a-year freight agent in every city "making a rate" on every crate of eggs, every box of goods, paying rebates, and inviting bankruptcy, there is little show for the owners of the railroads.

The present disclosures of criminal mismanagement of railroads has made many converts to the idea of governmental control of railroads, but sure it is, that in the hands of private enterprise our lines will be developed much faster than if they were in the hands of the general government, and anything that develops the railroads, develops the country—and that is a great necessity.

Men who work for railroads should be as much interested in the prosperity of the roads as in their own fortunes—for one controls the other—and there should be no distinction between the employé on a train and the employé in the president's chair.

If the press who bewail the destruction of railroad property by mobs will but investigate a little, they will find that the cash value of all the railroad property ever destroyed by mobs and strikers would not pay the legal rate of interest on the value of railroad property looted by its managers in the last year.

Honest men court honest, open, above-board methods—and God knows American railroad management needs some of this kind of sunshine. Only poisonous weeds grow in the dark. Let there be light.

Dangerous Improvements.

The above title was suggested to the writer while examining some coaches on a large New England railroad last week.

The dangerous improvement consisted of a small chain, one end of which was fastened to the handle of the angle-valve of the air-brake train-pipe, running diagonally to the rear of the steps, the other end was secured there.

This device was evidently intended to allow the trainmen to close the angle-cocks without getting under the cars—at first sight a handy little thing.

There are more reasons than one why this is a dangerous improvement.

In the first place, it increases the danger of the cock being accidentally closed a hundred per cent. It was found that the old, plain straight-way cock, with the handle standing at right angles to the pipe, would, could and did get shut accidentally by flying pieces of ballast, coal, etc., and the new angle-cock with the handle on top of the pipe and parallel with it was a better protection. Now this chain insures the closing of the cock if anything strikes between the center of the car and the rear of the steps, a stick, a loose brake-rod or what not may close that cock—and when the train refuses to stop, those responsible will say it was a "failure of the air-brakes," and honestly believe it.

In the second place, it is dangerous to equipment, because the temptation is great for the well-dressed brakeman to "pull the string and let the engine do the rest"—pull the hose in two without uncoupling by hand.

In the third place, it don't do any good in coupling up, and the supposed good in uncoupling is dangerous. If there is any one thing that passenger brakemen and switchmen ought to do, it is to go under the platforms, close the cocks and uncouple and hang up the hose *by hand*, or take it down and couple it up.

We have laid a great deal to the tramp that should have been charged up to carelessness in coupling hose and turning angle-cocks, and neglect to test the brakes before starting on a run.

That little chain running back to the steps, where it can be easily reached between them, is a constant temptation for boys and other curious persons to pull it to see what it does—it apparently does nothing, but in fact it does everything, and all looking to possible disaster, never toward safety.

It should be made more difficult, rather than less difficult, to close these cocks than to open them, or else opening one should set the brake then and there.

The power to stop a train is of as much or more importance than the power to start it, and the means to that end should be the best in the world, the most carefully inspected and most jealously guarded. If your brakemen wanted to carry kegs of gunpowder in the smoking-car or your children wanted to play with your revolver, you wouldn't listen to it—because you know either practice to be simply fooling with human life. Don't let any one juggle with your air-brake apparatus—it's loaded.

Diverse Experience with Draft Appliances.

There is no theme connected with locomotive operating that keeps itself so persistently before railroad men as the causes which affect the free steaming of the engines. Given a locomotive with a boiler suited to the size of cylinders, fairly good fuel to burn in the firebox, and we are certain to have a free steaming engine, if the draft appliances are so arranged that the gases of combustion flow freely and evenly through the flues. This "if," however, is very important, for greatly diverse results are obtained on different roads with the same form of draft appliances. We have repeatedly heard it said that accurately conducted shop tests of locomotives would demonstrate with precision what form of draft appliances were calculated to give the best draft with the least obstruction to the exhaust steam, and from that it would be an easy matter to establish a standard form of draft appliances. Standard draft appliances would be practicable only with coal of perfectly uniform quality, and all the conditions of train operating the same. Where trains are light and run at moderate speed, draft appliances can be employed which would lead to delays for want of steam on roads where the trains and speed were kept up close to the full capacity of the locomotives. Mr George Gibbs, mechanical engineer of the Chicago, Milwaukee & St Paul, who has been employed a great deal making tests of draft appliances, while discussing the subject, asserted that there is a certain arrangement which is best for a given service, but it must not be inferred that all others are bad. The probability is that each road has for years experimented with and discussed the draft appliances which are standard on its own locomotives, and made changes until it has a fairly satisfactory arrangement for each class of service, fuel, etc. Discussion of draft appliances must be upon broad principles and not upon details. There are two main principles which appear in discussing the subject—the first being to obtain requisite steaming capacity for the locomotive under all conditions of service, the second to obtain maximum fuel economy. Steaming is the essential requisite. The two requisites may not work out in one device. In the different elements which go to make up a successful draft arrangement, there are at least a dozen different conditions, any one of which has an enormous effect upon the efficiency of the device. If you change any one of these, you are going to injure or improve the steaming capacity of the locomotive. As the number of possible combinations of draft arrangements are almost infinite, it is not surprising that experience has evolved a multiplicity of designs.

Turning to personal experiences, Mr Gibbs related particulars which appeal very forcibly to every engineer who has experimented with draft appliances. He said: "Some years ago I started with great enthusiasm to figure out the best possible arrangement of draft appliances for locomotives, and it took me several months to come to the conclusion that I knew less than when I began." The remedy which he proposed for the inconclusive experience of draft appliance tests on the road was a series of shop tests.

A curious illustration of draft appliances that were successful in one place failing utterly in another was given by Mr. C. H. Quereau, engineer of tests of the C., B. & Q. He told that Herr Von Borries, of the Hanover State Railway, interested the C., B. & Q. people in the draft appliances they use in Germany. Drawings were obtained and an engine equipped with the German device. There was no baffle plate, and the nozzle was set high, reaching almost to the base of the stack. The best fireman to be found was assigned to the engine, but it could not be made to steam on a through train, even when the nozzle was reduced. After a thorough trial they had to abandon the arrangement. They put on a smaller stack, 13 inches at the choke, applied the standard baffle plate, lowered the nozzle so that the tip was only 3 inches above the center line of the boiler, and enlarged the nozzle from 4½ to 4¾ inches. These changes enabled the engine to steam freely. We wonder if the German railway people would not materially improve the working of their locomotives if they made similar changes on their draft appliances.

The results of several years' experience are shown in another part of this issue, in the article by Mr. W. H. Thomas, the well-known superintendent of motive power and machinery of the E. T., V. & G. (that was). Mr. Thomas has undoubtedly found the best device extant for the conditions on his road but this does not necessarily follow that the arrangement would be equally successful under different conditions. The road under this writer's charge covers a large territory, however, and the fact that he is using the largest nozzle in the country, and has been for a long time, looks as if he might have struck a pretty good general average of a device.

Who Has the Best Cinder Pit?

Mr. Walter Berg, principal assistant engineer of the L. V. Ry., chairman of the Committee of the Association of Railway Supts. of Bridges and Buildings, is sending out inquiries about cinder and ash pits, the substance of which is as follows:

"What system for dumping and removing ashes from locomotives is in use on your road? Give general description and the location, whether in a main track, side track or special track.

If a pit is used, give depth, clear width and length, and describe in general the kind of foundation, materials in side wall and bottom of pit, coping, rail fastenings or supports, drainage, and the methods used to protect against heat.

If a conveyor system, elevated platform with dumping trestle, or other method in use, describe same, giving principal dimensions, materials and details.

What is the arrangement, location and height of ash-car track in relation to the pit or dumping track.

What kind of coal is used? Does the choice or dimensions of a cinder pit system depend, to a certain extent, on the kind of coal used, and, if so, in what respect.

It is particularly desired to obtain first cost of cinder pits or other systems for removing ashes; also the unit cost of operation (i. e., handling the ashes from pits to cars), and the output capacity of a pit or plant of given size.

We are especially desirous of obtaining blue prints of cinder pit systems in actual use on your railroad, with such remarks as you may feel willing to make on the efficiency of the design, the reasons for its adoption, and any possible improvements you might have to suggest or general views to offer on the subject of the best system to recommend under stated conditions."

Of all the ingenious plans devised at our different roundhouses this committee ought to find something worth recommending; then if they could only make railroads that clean ash pans on the ground, and require their firemen to keep clean engines, adopt something decent in the pit line they will confer a real boon. Many and many a fine engine has been ruined by cutting driving brasses and motion work caused by the want of decent facilities for cleaning ash pans.

Mr. Eddy, Commissioner of Railroads for the Government of New South Wales, Australia, cabled that the picture of exploded locomotive boiler, shown in our July issue, was not a New South Wales locomotive, and that they had not suffered an explosion for twelve years. The editors will have to take the blame of mislocating this engine; the photograph was sent us by a reader in New South Wales, with the simple notation "Just to show you how boilers sometimes 'let go' in the Colonies." We assumed that the "let go" occurred in New South Wales. It evidently did occur—the camera tells no lies—but it was doubtless over the fence in Victoria, Queensland or South Australia. We shall try to find out, as we have no desire to state anything but the truth.

BOOK NOTICES.

DISEASES OF THE AIR-BRAKE SYSTEM, their Cause, Symptoms and Cure. By Paul Synnestvedt. The W. T. Hall Printing Co., Chicago. Price, $1.

This work needs no recommend at our hands, it has appeared in this paper in serial form during the past year. The book is most conveniently gotten up for ready reference, each cut being independent and occupying no more than a page, thus avoiding folders and insets. The work is intended for those having repairs to make to air-brake apparatus, and illustrates and treats of old devices as well as new ones, and of all makes in common use. The ground covered in this work is different from that covered by any other publication, and ought to make the work of the author appreciated. It is well-worth the price, of any man's money who is interested in air-brake work. This work should be in the hands of every progressive engineer and fireman.

POCKET PRIMER OF AIR BRAKE INSTRUCTION. By W. S. Rogers, M. E. Published by the author. Buffalo, N. Y. Price, 50c.

This little work was compiled by Mr. Rogers, while he was employed as air brake instructor of the Delaware & Hudson Railway, and is something odd in the instruction book line, following in no beaten path, and, therefore, being new. The author uses several of what he calls charts to illustrate his ideas of instruction, but instead of being pictures they are composed of titles of essential parts of the brake apparatus so arranged that the relative parts shall be connected in the student's mind. For instance, the first one is as follows:

Compressed air
- 1. Source
  - 1. Pump capacity?
  - 2. Pump limit?
- 2. Storage.
  - 1. Main reservoir?
  - 2. Engineer's valve reservoir?
  - 3. Train line?
  - 4. Car auxiliary reservoir?
  - 5. Brake cylinder?
- 3. Values
  - 1. Pressures?
  - 2. Quantity or volume?
  - 3. Quality?
  - 4. Compression?
  - 5. Expansion?
- 4. Time
  - 1. Charging main reservoir?
  - 2. Charging train line?
  - 3. Charging auxiliaries?
- 5. Waste?

He makes a question of every item and the subject matter in the book is intended to get the student's mind in a condition to intelligently understand the relations these parts bear to each other.

The book contains some plates of engineers' valves and triples, and has special instructions to trainmen, inspectors, and others each in his particular line. The book is well worth its price to any man whose living is earned by working with air brakes in any capacity.

PERSONAL.

Mr. W. H. Harding has been appointed mechanical engineer of the Seaboard Air Line.

Mr. D. C. Frederick has been appointed car service agent of the St. L., C. & P., in place of Mr. B. L. Babb, deceased.

Mr. C. A. Swineford has been appointed superintendent of the Butte, Anaconda & Pacific, vice J. J. McLaughlin, resigned.

Mr. H. W. Gays has been appointed traffic manager of the St. L., C. & St. P. R. R., with headquarters at St. Louis, Mo.

Announcement is made of the death of Mr. Mordecai W. Jackson, founder of the Jackson & Woodin Manufacturing Co., of Berwick, Pa.

George Potter, master mechanic of the New York Central at Rochester, recently celebrated his sixty-fourth birthday. He was given a handsome clock by the men.

Mr. G. W. Conklin, master mechanic and trainmaster of the Bradford division of the Erie, has resigned and taken a better position on the Tonawanda Valley road.

W. A. Simsrott, the defaulting secretary and treasurer of the Switchmen's Mutual Aid Association, is believed to be insane. The association have denounced him as a defaulter.

George J. Loomis, an engineer and machinist, who helped to build the first locomotive made by the Michigan Central road, died at Ann Arbor, Mich., on the 28th of July.

Owing to the resignation of Master Mechanic Conklin, the jurisdiction of Master Mechanic Weiss, of the Western division of the Erie, has been extended over the Bradford division.

We will be under personal obligations for life to every correspondent who keeps his letter within the length of one column. You can say an awful lot in a column if you dig out the unnecessaries.

Mr. D. G. Mott, M. M. of the Panama railroad, at Aspinwall, Colon, has been spending a three months' vacation at and around his old home in Campbellton, New Brunswick. Mr. Mott learned his trade in Boston.

Mr. F. D. Adams, the well known M. C. B. of the Boston & Albany, favors our correspondents' column with a little light on the first inception of the M. C. B. Association, and places credit where it belongs.

Mr. Charles E. Turner, for some years past master mechanic of the Western New York & Pennsylvania, at Olean, N. Y., has been appointed superintendent of motive power of the Buffalo, Rochester & Pittsburgh, in place of W. T. Small, deceased.

Col. Edward H. Castle, who during the civil war was appointed by Gen. Fremont to be general superintendent of all western railway lines confiscated by the government for military purposes, and did very efficient service, died in Chicago on July 25, aged eighty-three years.

Engineer C. W. Kemp has run one engine—the "13"—on the Toledo, St. Louis & Kansas City road for 80,601 miles, without having her main rod brasses filed or out of the strap, and they were not "pounding" when she went into the shop. An engineer who can let his rod brasses alone for two years deserves a medal.

Mr. P. C. McNiven, formerly a draftsman at the Canadian Locomotive Works, at Kingston, Ontario, died last April in South Africa, where he had been for over two years. Mr. McNiven was a Scotchman, and came to Canada from Dubs' works, in Glasgow. He was a member of the American Railway Master Mechanics' Association.

President Cleveland appointed as commissioners to investigate the recent railroad strike at Chicago Messrs. Carroll D. Wright (U. S. Commissioner of Labor), John D. Kernan, of New York, and N. E. Worthington, of Illinois. This commission is in session as we go to press and is taking testimony from the men, railroad officers and outsiders.

Mr. H. O. Nourse, at one time the Chicago representative of the Searritt Car Chair & Seat company of St. Louis, has again taken a position with that company in the railway and street railway department, and will have his office at No. 941 Rookery, Chicago. Mr. Nourse will retain his connection with Smith's Locomotive Fire Kindling company as manager.

Mr. Henry Deane, engineer-in chief of construction of the government railways of New South Wales, Australia, called on us last month. Mr. Deane came to America via the Pacific, and has been looking over American railroad construction. He sailed for Europe on the 18th. While here he saw much of the great strike and was long delayed in the West by it.

Very few railroad men ever live to celebrate their golden wedding, either railroad work or marriage wears most of them out long before the fiftieth anniversary of the glad day. Mr. and Mrs. F. D. Adams, of Newton, Mass., are therefore to be congratulated upon their celebration, which occurs on September 4th. Mr. Adams celebrated his fiftieth anniversary as a car builder a long time ago.

Mr. Luther C. Challis, who died in Atchison, Kan., last month, was a western pioneer, a member of the first Territorial Council of Kansas. He built the first road west of the Missouri river—the Atchison & Pike's Peak, now the Central Branch of the U. P. He was instrumental, if not the chief factor, in starting the A., T. & S. F., and was at one time worth over a million. He gambled on Wall street, and died in poverty.

The car and locomotive departments of the Houston & Texas Central road have been consolidated, and Master Car Builder James McGee has been placed in charge as acting superintendent of motive power. This is one of the few instances on record where a man, whose experience has been entirely in the car department, has been given charge of the motive power. The M. M. swallows up the M. C. B. pretty often, and "turn about is fair play."

An engineer on the C., St. P., M. & O., sends us bulletin blue prints of their performance sheet that shows good service for a road in the West. We notice that for the whole system the engines average 30.7 miles per ton of coal, 32.0 miles for a pint of engine oil and 74.7 miles for a pint of cylinder oil. This is good service, and is doubtless due to the interest taken in the men and their work by the man in charge, Mr. John J. Ellis, superintendent of motive power of the system.

Mr. Timothy Hackworth Young died of consumption, at Sacramento, Cal., on July 21st. Mr. Young was an English mechanic of ability and a grandson of the pioneer locomotive builder, Timothy Hackworth. Mr. Young came to America about 1880, and soon after took the position of master mechanic of a road in Costa Rica, S. A., but his health failed steadily and he returned to the United States. He was division master mechanic of the C., M. & St. P., at Chicago, until 1892, when he was selected as assistant to the chief of the transportation exhibits of the World's Fair. While in this position he engaged to go to Mexico with Mr. Johnstone, on the Central. While the writer was in Mexico this spring he met Mr. Young at San Luis Potosi, where he had charge of the machinery of the water service. He was not satisfied there, and had just engaged to go to California to take a better position under H. J. Small, of the S. P. For a man in such precarious physical condition Mr. Young was particularly hopeful and courageous.

The necessity for "doing as the Romans do while in Rome," was the cause of two serious accidents to engineers on the National Mexicano road recently. Everybody in Mexico "packs a gun," and out on the road the nickel-plated handle of a six-shooter sticking out of the hip pockets of the trainmen causes a great deal of respect for persons and property. With very few [illegible] the men carry revolvers. [illegible] Engineer Cabel Smith arrived [illegible] train at San Miguel, and backed [illegible] into the roundhouse track. He [illegible] out of the side window joking [illegible], at the same time taking [illegible] clothes out of his seat box, [illegible] revolver was accidentally discharged; the ball entered his neck, cut the [illegible] and came out under the ear [illegible] death. Engineer Dick [illegible] serious accident from the [illegible] dropped his revolver in his [illegible] off, making a very bad [illegible] the leg, necessitating amputation [illegible] the knee.

Mr. I. R. Andrews has been appointed superintendent of the Atlantic Avenue Railway, in Brooklyn. This is the oldest [illegible] Island road, having been in operation for some thirty years, and was one of the first steam roads to change to electricity. Mr. Andrews, though a young man, has been employed on several lines in different capacities, from fireman up to [illegible] superintendent.

Thirty-five Years on One Locomotive.

Engineer Jefferson B. Clark, "Jeff," as the boys call him, recently delivered his engine to the Depew shops of the New York Central to be cut up. The engine—the "150"—was built in 1856 and was named "Burrows," after the well-known division superintendent of the Western division, who has recently retired from service. Mr. Clark took her in 1859 and ran her steadily until now—to be exact, thirty-five years, two months and twenty-five days. Of course the old engine has been rebuilt many times, but she and Uncle "Jeff" stuck together like lovers.

Everybody on the Auburn road between Buffalo and Syracuse knew Clark and his engine.

The officials offered the old-timer another engine on his old run, but he has been laying off since he lost the "150," and must feel something like a widower.

This is the longest case of "keeping his own engine" we have ever heard of.

At the last meeting of the M. C. B. and M. M. Associations, the band gave a Sunday concert in the Park, at which a collection was taken up for the Fresh Air Funds of the Chicago *Daily News* and the New York *Tribune*. Each of these funds received the sum of $87.11, for which the chairman, Mr. F. W. Coolbaugh, holds receipts. The relief of sick children by these two funds is a worthy charity and helps, every summer, something like 30,000 children and mothers in each city.

All the general offices of the Pennsylvania Railroad have been moved to the new station building on Broad st., Philadelphia. This is now one of the best, if not the very best, terminal station in America.

A Successful Rival.

There was once upon a time, and that time was not so very long ago, a general superintendent on the East Tennessee, Virginia & Georgia Railroad, who was famous in those parts, and even in adjoining states as a snorer. Local gossips said that this railroad superintendent was compelled to choose a residence in a thinly settled part of the city, because he was afraid that close neighbors might raise a riot as a slight protest against the unearthly noises which he created while engaged in his nightly slumbers.

We do not know whether it was that he delighted to be in an atmosphere of other noises or not, but this superintendent was much given to traveling at night in his private business car, and being of a social disposition, he liked to have division superintendents, paymasters, master mechanics, car builders and other officials to bear him company. His accomplishments as a night warbler being well understood, there was general hesitancy about sharing his state-room. The porter in charge, who understood the situation, used to act in a spirit similar to the Moguls of India, at state dinners.

Madras, in the early days of British occupancy of India, was terribly infested with mosquitoes, and it was almost torture to sit through an evening at one of the prolonged state dinners which used to be then customary. It is well known that mosquitoes prefer fresh blood, to that which is thinned by many summers of wasting sunshine, and some genius discovered that by placing a few new-comers at each table, all the mosquitoes' efforts were directed to them, and the high dignitaries were permitted to feast in peace.

Well, this shrewd porter, acting in the same spirit, would always put in any stranger who happened to be with the party, beside the snoring superintendent, and in the morning the others would enjoy a great deal of amusement finding out how the new-comer had spent the night.

Now, it came to pass that Mr. E. M. Roberts was appointed master mechanic of the road at Atlanta. The cares of his new office had scarcely touched his head when he was invited to go out with the general superintendent on a tour of inspection. There was a very pleasant party out in the car. They spent a very pleasant social evening. Mr. Roberts' story-telling qualities meeting with great appreciation from his fellow officers. But the best of good things must come to an end. Stories were finished, anecdotes laughed over, and reminiscences ended by a call that it was time to go to bed.

Mr. Roberts was gently ushered into the general superintendent's state-room, with the information that the extra berth was for his accommodation. Not a word was said about the snoring accomplishments that he was about to be introduced to. Everybody retired to rest, after a brief season, the usual noises proceeded from the general superintendent's room, and the others were grinning about the fine time the new superintendent of motive power was having.

In the morning the general superintendent walked out into the observation room, and no one had ever before seen him in such a dolorous condition. "What's the matter?" inquired the paymaster, with anxiety portrayed on his face. "Are you sick, Mr. General Superintendent?"

"Sick? No, I am worn out. Haven't had a wink of sleep all night."

"Whatever was the matter?" inquired several. "We thought we heard you sleeping."

"Matter? I couldn't get to sleep for that master mechanic's snoring."

"You kept from sleep by anyone snoring, Mr. Superintendent? We always thought you could look after anybody in a case of that kind."

"So I could, generally, but Roberts took a mean advantage of me. He got to sleep first."

Those English Engines in Mexico.

Mr. Henry E. Walker, superintendent of motive power of the Mexican Southern, says the J. P. mangled the truth in some of his statements about his engines, and after a perusal of his very fair and good-natured letter the J. P. owns up that he must have been mistaken. Mr. Walker did speak very highly of the American locomotive, and the writer remembers that we had been talking about repairs before; on this subject Mr. Walker wishes to be quoted correctly, and says: "* * You say that I think the American engine is adapted to the work and that the English is not. I must emphatically deny ever having made such a statement. An engine better adapted to the work they have to do than our Kitson Class A engine it would be difficult to find. A photograph of this engine was given in your issue of September, 1893. The American locomotive is certainly the handier to do repairs on, but as a piece of machinery she is not in it with the English make. My locomotive performance sheet shows that during the past year the cost of ordinary running repairs was for three Baldwin locomotives 3.35 cents per kilometre, and for fourteen English locomotives 2.06 cents per kilometre (Mexican currency). One of the gunboats which you decry has been working continuously for the past nine months (after a general overhaul), and her running repairs during that period have cost only 1.77 cents (Mexican currency) per kilometre. I may say that the total cost of repairs last year, including all back-shop work, averaged for the seventeen engines 5.04 cents (Mexican currency) per kilometre, equal to 8.06 cents per mile (4.05 cents gold). * * * * * " Mr. Walker also says those steam pipes on the "gunboats" are 3⅞ in., and that the exhaust pipe does not go nearly straight across. The J. P. evidently laid all the faults found on the system to the "gunboats"—and the half were never told—but the aforesaid J. P. will hold up his lily-white hand and swear that there are engines there or thereabouts with the exhaust pipes that do "go nearly straight across." We had no desire to misstate, and honestly tried to be accurate (and easy) about those "gunboats"—they are awful examples. We agree now, as we did in the article, that those little Kitson ten-wheelers are all wool and a yard wide.

Report of the Proceedings of the American Railway Master Mechanics' Association, in its twenty-seventh annual convention, held June 18th, 19th and 20th, was sent out July 21st. It was issued one month after the close of the meeting—this was very quick work, especially when it is known that, owing to a mistake in loaning cuts to the *Railway Age*, they were sent to Chicago and lost in the strike riots—every one had to be made a second time. Angus Sinclair, the secretary, worked night and day in compiling the report, and the printers got an unusual hustle on themselves. The report contains 310 pages besides numerous insets. The subject matter is very interesting and the typographical get-up above the average.

The fourth biennial convention of the Grand Lodge, Brotherhood of Locomotive Firemen, will meet at Harrisburg, Pa., on September 10th. Something over five hundred delegates meet at these conventions, and a good time is always had. The present convention will have plenty of work before it. The order has done a world of good—and it is not through yet.

There are considerable many inquiries about locomotives and rolling stock going out, and quite a number of roads are on a still hunt for "rock bottom" prices, etc., etc. Almost everybody says we are going to have better times now, and if those who say so, think so and act so, better times we will have.

EQUIPMENT NOTES.

The Calumet & Blue Island is in the market for engines.

The Seaboard Air Line is in the market for ten locomotives.

The Reading shops of the P. & R. are running double time.

The Erie is having one hundred cars built at the Buffalo Car Works.

The Cooke Locomotive Works are working on some Government orders.

It is said that the Wisconsin Central will buy two complete vestibuled trains.

Baldwin's have an order for three locomotives from the Elgin, Joliet & Eastern.

The Indiana, Illinois & Iowa are reported to be in the market for two or three freight engines.

Robert Hardie is building a compressed air locomotive at the Rome Works for street car service.

The Illinois Central are in the market for 500 new cars—fruit, refrigerator, box, stock and coal cars.

The Atlantic Avenue Electric road in Brooklyn, now runs mail cars to the suburban towns on its line.

The Falls Hollow Stay Bolt Co. writes us that their mill is running full time on all sizes, and that they are therefore ready to deliver at once any order.

Mr. Webb, of the London & Northwestern, has just turned out eight new three-cylinder compound engines of the same class as the "Queen-Empress" shown at the Fair last year.

Locomotive building is on the pick-up. The Brooks Works, at Dunkirk, have completed two for the Toledo & Ohio Central. Eight engines will be begun at once at Altoona for the Pennsylvania road. They will be of the "Class R" type.

The Rogers Locomotive Company are at work on fourteen engines for Cuba—ten having just been shipped on a previous order. They are also building one engine for a private concern in Brazil.

The East & West Texas railroad which has just been widened from narrow to standard gauge, has received six passenger coaches, two baggage, two mail and express cars from the Barney & Smith Car Company, of Dayton, Ohio.

The Ajax Metal Co., of Philadelphia, Pa., have rechristened their anti-friction metal, formerly known as Ajax White Metal Alloy, the new name being "Ajax Tin." They publish the proper formula for mixing their metals for different purposes.

During the war there were many men employed as engineers and machinists on the military railroads of the United States. There is an attempt being made now by a few of these old-timers to get together, talk over old times, etc. Who are eligible? Write to this office.

Maxim's steam flying machine recently broke the track above that held it down while being experimented with, and rose in the air with three men on it. They were not ready for business, and the machine came to grief. This machine has a 300-horse power engine, and has proven that it can lift itself into the air. Humanity will navigate the air yet.

—Practical Letters— from Practical Men.

Facts Wanted. There's a glut of Opinions.

Write on one side of the paper, state your point plainly and briefly, and then quit. We supply the generalities. No letters noticed unless name and address are annexed.

Who First Suggested the M. C. B. Association?

Editors:

I am extremely sensitive, and very much like to see justice done in all cases, and I am also well aware that but comparatively few of the present membership of the M. C. B. Association have any definite knowledge of the real origin or who was the first man to suggest the idea of a national organization. While Mr. Kirby is certainly entitled to great credit in the early work of the association, and Mr. Kenny and myself are the only living members who were at the meeting mentioned in your article on page 234, July number, excepting Mr. J. H. Van Houton and John P. Lavan, of the Penn. R. R. They were sent there, to Adrian, by their superintendent, Dr. Williams, to see and make our acquaintance and learn what the objects were that called us together. The idea of anything beyond our own line, from New York and Boston to Chicago, had not entered the mind of any of us until after listening to our discussion as to the needs of Red Line cars, which then was the only through line organized, Mr. Van Houton asked the liberty to speak, and of course we were pleased to hear him. He talked at some length, expressing himself pleased with the discussion and object, etc., and said that while listening to our discussion the idea came to his mind that it would be a grand thing to call together the car masters of the United States and Canada to form themselves into a national association. He said he hoped before we adjourned we would take some action in this direction, and further suggested that we instruct our chairman (Mr. Kirby) to issue a call to all the M. C. B. to meet at some time and place we might agree upon. This was done unanimously, and I claim that to Mr. J. H. Van Houton, now in charge of the Penn. shops in West Philadelphia, belongs the honor of first suggesting and organizing the M. C. B. Association. Let honor be given to whom it belongs. One other mistake I see. Mr. Kirby held the office of president two years instead of one.

I write this, thinking you, as well as many others, are not fully posted as to all the early experiences of the association. The present members would hardly recognize it in its early days.

Allston, Mass. F. D. Adams.

"One of the Handy Tools."

Editors:

Inclosed please find sketch of one of the handy tools for shop and roundhouse use. While it is old to some, it is not generally known for its merits of usefulness to many.

Fig. 1 shows side view of screw clamp *A* with key *B*, and gib *C*, with section of eccentric rod *D*, or piece to be bent, straightened or twisted, as the case may be.

Fig. 2 shows top view and method of application to eccentric rod.

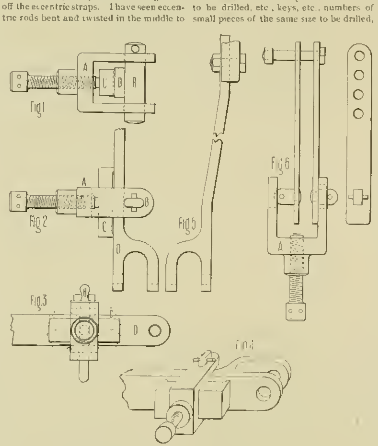
Fig. 3 shows end view of screw clamp and side view of eccentric rod, etc., and the several positions that gib *C* can be applied to straighten, bend or twist eccentric rod *D*, or other work.

Fig. 4 shows perspective view of screw clamp and method of application.

Fig. 5 shows how an eccentric rod or any other rod should be offset by two bends.

Fig. 6 shows screw clamp *A* without key *B* and gib *C*, and used as a spring puller that will pull.

For hanging links and putting up eccentric rods on locomotives, this device is invaluable. There are many ways and customs of doing this work, and they are all attended with the usual awkward, unhandy and time-killing ways of getting at them, such as taking down and into the blacksmith shop to have an offset put in them of an inch and a half or so. Also taken down and peaned on the rail also a sledge held on one side and mauled on the other side with a sledge, and more likely than not break off the head on the eccentric strap by so doing, all of which is unnecessary and unmechanical, and in these exciting times we might say un-American. With this device the eccentric rods can be offset, straightened or twisted in a very short time very easily without taking them off the eccentric straps. I have seen eccentric rods bent and twisted in the middle to



A Handy Shop Tool.

get them into position. This should never be done under any circumstances, as it spoils the rigidity of the rod and will cause it to spring, and the eccentric or link will run hot. Any such rod, where tension or rigid resistance is required, should be offset or bent only at the extreme ends (see sketch, Fig. 5), and the middle of the rod maintained as straight as possible.

If the jaw of an eccentric rod should be twisted, and not come up square to the link, place the clamp on close to the jaw, as Fig. 2, and put gib *C* on a slant, as Fig. 3, dotted lines, and tighten the screw by the aid of a small steel bar, and the twist can be thrown at will.

Fig. 4 shows as throwing the jaw from you; if it should be desired to throw the point of jaw to you, put the gib *C* the other side of the rod against the key *B*, and leaving the clamp in the same position, turn the screw against the rod *D*, and if any twist is desired, slant the gib *C* up or down, as the case may be (see Fig. 3 at *C*), and proceed with screw and bar and throw point to you, and the twist, as desired, in or out at the top at the same time.

We will now suppose that a jaw is cramped rigid on the link sufficient to stand alone in its place without the bolt, now put a ¼-round stick of brass or copper in the bolt hole, to keep it from falling, put on the clamp the way you think is necessary to relieve it, now, as soon as the right tension is given in the right place, the jaw will fall free on the brass, and be free on the link, and this is the quickest possible way to find what it wants. Now give the screw a little more tension, as the rod will spring back some, and you have it O. K.

The clamp can be used on many parts of an engine, such as rocker arms, tumbling-shaft arms, reach rod, valve rods, band rails, pilot braces, run-board brackets, etc., without taking them off the engine; it also can be used as a spring puller, but should have another and longer screw for this purpose. Take two pieces of ¾ x 2½ spring steel, any length necessary, anneal it, and punch a series of ⅝ holes in one end, and one hole in the other, to rivet in lug (see Fig. 6), to fit key way hole in clamp, and you have a spring puller that will pull.

It can also be used to clamp dies for bolt machines, to drill and plane, small boxes to be drilled, etc., keys, etc., numbers of small pieces of the same size to be drilled, planed, babbeted, etc., and many other ways that are constantly presenting themselves. These clamps have been in use in the A., T. & S. F. R. R. shops—shops that have a national reputation for handy appliances and where shop kinks are always encouraged by the officials of the mechanical department.

Topeka, Kan. A. P. Goodrich.

Figured Wrong.

Editors:

In reply to Mr. Holmes' article, in your August issue, permit me to say a few words. He agrees with a statement I made in a former number, that the rings of the equalizing piston in the latest engineer's valve are seldom tight (it is not necessary to have them so), but says he has seen valves which, with the handle on lap, would not indicate train pipe reductions on the gauge to any appreciable extent while the engine was standing still, but did better while running. I have also seen valves which were tighter than the one the test of which I cited, but none as tight as he seems to have found, and I am inclined to the belief that the gauge, more than the valve ring, was accountable for the difference. The pressure reduced slowly, but the gauge did not show it except when the engine was running, when the vibration caused it to register more acurately.

I confess I am somewhat at a loss to answer the criticism on the tender brake, because it seems to be based on a peculiar misconception of the purpose for which the cut referred to was inserted. It also appears that Mr. Holmes does not read the drawing correctly.

Throughout his calculation is based on the incorrect assumption that the end to which the hand brake rod is attached is the fixed fulcrum of the front cylinder lever. More careful examination of the cut will show that the hanger guide, which supports this lever (the one next the triple valve), has a long slot in it for the purpose of allowing a pin to travel forward when the hand brake is applied, and it is this pin which is the fulcrum in applications by *air* pressure. The distance from this pin to the point at which the cylinder tie rod is connected is equal to the distance that corresponds to it on the other cylinder lever, thus *equalizing the power on both trucks*. As to the calculation in regard to the brake beam levers, it is to be noted that the cut indicates clearly that they are shown at an angle, or as it were in projection, in view of which they cannot properly be used as he suggests, nor was that the intention, the purpose of the illustration being only to show the general arrangement or disposition of the parts and not the proportion of levers, as that must or should be figured out in each individual case, the same as is done in equipping cars. Paul Synnestvedt.

Chicago, Ill.

Friendly Criticisms of the Prize Designs—Their Faults.

Editors:

Permit me to say that in the prize designs shown in your August issue, one of your conditions appears to me to have only been partially complied with—the safety of engine crew and of the traveling public in case of accident. In your prospectus (if I may call it so) mention was made of the wreck on the Colorado Midland, where a boiler check was knocked off and passengers were scalded to death. The story of a fireman was also related, found with steam pouring from mouth and nose, caused by the penetration into his body of the broken end of a steam gauge pipe.

Prize Design No. 1, excellent as it no doubt is, shows checks outside the boiler, and though not quite so liable to be knocked off as if placed on the side of the boiler, still they are liable to be crushed down or broken off in a rear collision. Their protective value over the same kind of check on the side is only slightly greater. The turret from which steam is drawn has a thin neck, and would presumably break at the thinnest part. The scalding of the fireman mentioned above is still quite possible, because if the turret did not break off, the steam gauge-pipe, if broken, would continue to pour out live steam. For the matter of that, so might the injector steam pipes, blow pipe, air-pump pipe, lubricator pipe and steam-heater pipe, bell ringer and any other which had its origin in the turret. If the turret was broken off at the thinnest part, it would still leave the wings of the protecting valve exposed, and though it might hold the steam in the boiler, yet a blow from any falling piece of debris, occasioned while extricating passengers from a wrecked coach, might easily open and permanently unseat the protecting valve, and so permit the escape of steam and water.

Prize Design No. 2. The same objections appear to me to apply here also. Unless the turret is actually broken off the safety appliance would not come into play at all, and the chances of this most useful action of the valve are still further minimized to protected position selected for the turret. If the turret was broken off and the protecting valve closed the steam passage, still the exposed wings of the valve are liable to accidental contact with debris and wreckage with the same fateful result as is now possible in ordinary American locomotives.

Prize Design No. 3 would be quite as objectionable in a collision as are the ordinary unprotected engines in use to-day, because if any of the globe valves which are attached to the auxiliary dome were broken off, say by a passenger coach being thrown upon the locomotive, the steam and water would escape as readily as it can now from the unprotected turret in common use. The throttle arrangement might be an additional source of danger in case of collision. Even if the engineer had shut the throttle at the first approach of danger, it could be opened by the upright arm striking some projecting obstacle and so turning live steam into the steam chest and perhaps into a derailed coach through the broken opening of air-valve, broken cylinder cocks, or perhaps broken cylinder cover, steam chest, or cylinder.

In none of the designs have the safety valves been protected externally by a strong shield, in case the engine turned over in a wreck, and an exposed blow-off cock is as fearful a menace to life as are any other of these deadly openings. I have called attention to these matters because there is one fact that must strike the careful observer, not only of these designs but of your Educational Chart No. 2—one of the finest, if not the finest, American locomotive of to-day. It stands there utterly unprovided with the least improvement for the protection of life and limb. A misplaced switch or a moment of forgetfulness might convert this useful machine, and indeed most of the locomotives of to-day, into the most fearful messenger of agonizing death for locomotive runners, trainmen and travelers. Half the fatalities of railroad wrecks, and more than half the tortures can be prevented if the steam can be kept in the boiler. Mr Editor, will these designs do it?

Windsor, Ont. Geo. S. Hodgins.

[We have received many letters about the prize designs, serious, sarcastic and funny, and as we can not publish them all we select this one as being the best. It is not our intention to fill these columns with *arguments* and *opinions* about these designs. We offered quite a large sum of money, $150, for a prize to induce men with ideas to bring them out, left the matter to a committee, who did their work, we are sure, conscientiously, and we paid the money without a quibble, an if nor an and. *We do not think any of the designs offered were of any particular value to railroads.* Few of them presented *original* ideas that came within the bounds of reasonable possibility. The winners were common-place designs departing very little from the general practice of the country. As pointed out by our correspondent, any turret affair with a (so called) self-closing cock is a delusion and a snare. The self-closing cock is never shut except in an accident, and then won't close tight, any cock in the turret, or any pipe may break and in no way tend to close the valve, doing all the damage that could possibly be done. There is a chance for a good invention in the turret line, one that will close in an accident, *whether broken or not.* Checks should be taken off the side of the boiler, and we believe they can do less damage if placed on the boiler head, but inside checks have their grave disadvantages. Safety valves and blow-off cocks are a source of great danger and need greater protection. To those who are disappointed, let us say: Don't write letters, but send in details of suggested improvements of parts, we will act as judges ourselves, and if designs have the germ of an idea in them we will be glad to publish them. The contest has had one good effect, it has started a lot of bright men to thinking on this line, and in time a great improvement will come out of it.]

Tool for Finishing Solid Rod Cups.

Editors:

The question of securing oil cups to the rods of locomotives in such a manner as to prevent their loss has been a perplexing one to many. In the ordinary manner they are secured either by an independent keeper on the inside of the cup, or the cup

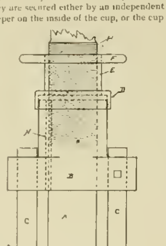


Fig. 1.

Fig. 2.

is made with a stud in the bottom to screw into the rod. The difficulty has been to so secure the cup that the engineer in screwing or unscrewing the top, often with a wrench, will not loosen the cup, and consequently lose it by jarring out after a short run, or in cup where the oil is supplied without removing the top the cups often jar loose and are lost. On some roads this continual loss has been partially remedied by forging the cups on all new rods. The use of solid cups would no doubt be extended were it not for the expense in fitting them up. As some suggestions in this line would doubtless be acceptable to many, I submit the drawing of a tool I have found to be very convenient for this purpose.

Referring to the drawings, Figs. 1 and 2 represent the oil cup forged on the rod. The cup is first drilled the diameter and depth desired. The tool consists of a spindle *A* of the diameter of the hole in oil cup (if more than one size is used, bushings to fit on the spindle will be found convenient), on which is a movable sleeve carrying two steel rods to which are attached the cutters. The spindle *A* has on its upper end a left hand thread, and on this a bush to which is secured a star wheel, to be turned by a pin secured to the drilled press in such a manner as to turn the star wheel one point each revolution of the spindle. The bush to which the star wheel is secured is fitted to the left hand thread, and on its lower end has a collar bearing on the sleeve *B*, to which it is secured by the nut *D*, then, as will be seen a movement of the bush *E* will cause a corresponding movement of the sleeve *B*, carrying the cutters. The key *N* prevents the sleeve *B* from turning.

This tool will be found useful for other purposes. For link hangers, where no lathe is at hand large enough to swing them or milling machine to shape them up, and for many other purposes that a wide-awake mechanic will be apt to find. To those who desire a cheaper tool, it can be had by making the sleeve *B* stationary and feeding with the ordinary feed of the drill press. This method will require more adjusting of the tools and will be found less satisfactory.

If for any reason it should be desired to finish the outside of the oil cup first it can be done by simply drilling a small hole, say ¼-inch, in the top of the oil cup to receive the tit K, which which will act as a guide and support for the tool. This tool can be secured to the spindle of the drill press by a set screw, or by the device suggested by Mr. Bingley in May issue. I can say the device is an excellent one, as I used one similar to it a number of years ago on some six-spindle nut-tapping machines, in that case I had a spring to release the key when the collar or sleeve was raised, and a stop to prevent the sleeve being raised too far, this arrangement being necessary from the fact that the spindles were not sloped.

Reading, Pa. F. M. Arthur.

Cutting Quadrants.

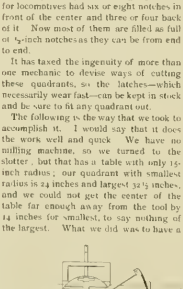
Editors:

Almost every part of the modern locomotive is a development of something similar, a steady growth, an evolution.

A few years ago the average quadrant for locomotives had six or eight notches in front of the center and three or four back of it. Now most of them are filled as full of ½-inch notches as they can be from end to end.

It has taxed the ingenuity of more than one mechanic to devise ways of cutting these quadrants, so the latches—which necessarily wear fast—can be kept in stock and be sure to fit any quadrant out.

The following is the way that we took to accomplish it. I would say that it does the work well and quick. We have no milling machine, so we turned to the slotter, but that has a table with only 15-inch radius; our quadrant with smallest radius is 24 inches and largest 32½ inches, and we could not get the center of the table far enough away from the tool by 14 inches for smallest, to say nothing of the largest. What we did was to have a



Slotting Quadrants.

block forged, size and shape shown in Fig. 1, and fitted to cutting bar and held with one bolt and turned in toward throat of machine. There are three 2-inch holes through it, with set screws on one side. The post for holding the tool is 2¼ inches in diameter outside the block and fits in the 2-inch hole, filed flat on the side where the set screw comes, that lets us get the tool back part of the way. We then made an extension to put on screw, so as to get the feed gear out past where the table would come. We also had to change the nut on screw. This was easily done by drilling two new holes for the bolts that held it on. We now have the center of the table back far enough for all purposes to hold the quadrant, which has first been planed to thickness. We take two bars of iron, 1 x 2½ inches, the length of radius. Through one end drill 1-inch hole, to fit on pin that has been put in center of table. One of the bars will have to be bent so that they will both be on the pin and level at other end, in which holes have been drilled same size as ones in quadrant. Three straps will hold this firm on the table.

Take an old binder, plane one side level, put a block on each end planed to the same level as the ways, through center drill 1½-inch hole, turn a piece of iron to fit and cut off just long enough to touch quadrant, as in *A*, Fig. 3. Work on two quadrants at one time, the first move will be to trim off the outside to the exact radius.

To space the teeth take a gear from one of the largest lathes, and if it fits on shaft that revolves table, you're fixed, if not, make a sleeve so that it will. Make piece as *R*, Fig. 2, this is to set gear by. Now by knowing how many teeth it will take on the gear to one on the quadrant you will be ready to go to work.

Find out how many revolutions of gear to turn the table once; multiply by number of teeth in gear. This will be the number of teeth in one revolution of table. Find exact length of circle with radius of your quadrant. If the quadrant teeth are to be ⅜ inch, get it in eighths, divide by three and you have the number of teeth. Divide the number of gear teeth by this and you will know how many teeth your gear will have to be moved.

We have turned four and cut fifty-two teeth in two quadrants in ten hours.

To cut latches take a bar 1 x 6 inches and long enough to put block on one end to hold the latches, the same as they would be on the reverse lever, Fig. 4. One plate will do for all lengths.

W. A. Robertson.

Cedar Rapids, Iowa.

Air Brake Instruction Kinks.

Editors:

An air brake instruction car is a good thing to have, in fact it is a necessity on any system that has over 100 engines. But we can't all have one apiece, they cost lots of money, first and last, some of us without any facilities at all except sectional valves and instruction books can have a temporary one that can be used in fine weather, using material already on hand.

First get the consent of the M. M. Then secure a good double-hand gauge and a small size single-hand one with ¼-inch fittings for pipe connections. Get four or five elbows, three or four nipples or short pieces of pipe about 2 inches long, one union—all ¼-inch gas pipe size—some bushings to couple ¼-inch pipes into ½-inch holes and one set for a ¾-inch hole, also a piece of ½-inch rubber hose 18 inches long, and two pieces of ¼-inch pipe 6 and 8 inches long. Take out the ¾ plug in the front head of 10-inch brake cylinder on opposite side from where ¾ pipe leading to auxiliary is coupled, and couple one connection of the double hand gauge into this casting which quick-action triple is bolted to, using piece of pipe 8 inches long, one elbow and suitable bushings so gauge will stand right side up. This will show pressure in auxiliary and *above* triple piston. Use the piece of hose, two nipples and union to couple the other connection of double-hand gauge to hole in check-valve case No. 13 where drain-plug comes out, this will show the pressure in train-line or *below* triple piston, both pressures showing on the one gauge. Then couple the small gauge to the brake cylinder at the oiling-plug hole, this will take two elbows, one of the 6-inch pieces of pipe, one nipple and suitable bushings, the object is to bring the small gauge just over the double-hand one, so both can be seen at once and right side up. This rig described is for a quick-action passenger equipment, the same gauges and connections can be used on a freight car, only it will have to be coupled to drain-plug in bottom of auxiliary reservoir, as that is the only place handy to get auxiliary pressure. With this rig, of course you will have to use an air-brake engine for an hour or two while "showing how she works." That don't cost much, and the "old man" won't kick very hard when he finds out what you want to use it for. To make it still more handy put a spare hose on each end of a piece of gas pipe, so the engine can stand alongside of the car with the gauges on, and with cab window opposite gauges so that the man at brake-valve on engine can see gauges on triple, that way he can see what is going on as well as in an instruction car working one brake—the piece of pipe and spare hose reaches from tender-hose on one track to car-hose on track alongside.

After you have tried this rig on a coach once or twice, and found how handy it is you will get on to other ways to couple it up, and couple other cars to the one with gauges, but the double hand gauge should be used to show the pressure on each side of the triple piston. With this arrangement, a great many assertions made about the operation of the air-brake can be proved, or shown to be mistakes, for the gauges show just what is going on all the time. All the connections can be made with hose instead of pipes, but it don't seem to work as well if you get the gauges very many inches from the triple-valve.

One thing will surprise you; that is the short time some of the brakes take to leak off when the car-repairers pronounce them O K and holding good. With this rig the operation of the quick-action part of the triple-valve can be shown very plain.

Draw the train line pressure down suddenly about 10 pounds, put the brake valve on lap, you will first see the hand showing train line pressure at triple come down moderately fast. When emergency-piston gets its work in, and opens valve wide, the hand will take a second drop, quick as a flash, showing the reduction of train line pressure by air going into brake cylinder, and the small gauge attached to brake cylinder will fly up to full pressure quicker than the eye can follow all of them at once.

You can also show the loss of auxiliary, and consequently brake piston, pressure after setting and releasing brake three or four times for one station stop.

About the third time it is set, you have only 35 pounds out of 70 to begin on. It will show that a reduction of 20 pounds out of 70 will generally set all the brakes in good order, with proper piston travel, to full pressure, and also show what to do to hold a leaky brake up to its work till the repairer can get it fixed.

To be sure the men that have instruction cars all fitted out in good shape will turn up their noses and brag up "our car," but that don't give you any chance to learn how—hearing them tell of their advantages.

Get at it yourself, put on the gauges some day, when you are laying out at the end of the division for the four or five hours that you have to yourself, and you will be surprised at how much this temporary instruction car will show you.

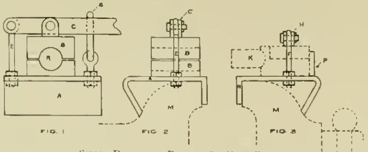
It will show you what some instruction cars wont: just how brakes work that are in actual service stopping trains, and how they work when pushing out against levers and brake beams instead of the release springs in cylinders set in racks. This kink is not a new one, by any means, but it may be new to some of the readers. Try it—"seeing is believing."

CLINTON B. CONGER.
Grand Rapids, Mich.

Simple Device for Putting on Hose Fittings.

Editors:

The fittings of air and steam hose will outwear the hose to which they are attached, and it is necessary to force the hose on them when renewing. This is not a very easy matter unless some device is at hand to



SIMPLE DEVICE FOR PUTTING ON HOSE FITTINGS.

hold the hose and fitting while they are being forced together. While there is no doubt a number of useful devices for this purpose, the one shown at Figs. 1, 2 and 3 has proved to do very satisfactory work. This device is used in connection with a vise, which is the means used to force the hose on the fitting, the rest of the mechanism merely holding the hose and fitting in position. The plates *A* and *N* are made of ¼ or ⅜ in. boiler plate bent to shape, as shown, so that the upper surface is level. The clamps *B* are of wood, of sufficient size to allow a hole through them large enough to take in the hose. The top piece is secured to the lever *C* by means of an iron jaw and pin. The lever is secured to the fulcrum *E* by a pin, so it can be thrown back or raised to allow the hose to be placed in position between the blocks. The coupling is held in position on the plate *N* by means of the lever *H*, connected to a block and fulcrum in manner similar to the lever *C* on plate *A*. The pins *P* act as a stop for the coupling. The levers *C* and *H* are held secure on the hose and coupling respectively, by means of the hooks *S* so as to leave the hands free. After securing the hose and coupling, as shown, all that is necessary is to screw the vise up, keeping the coupling well oiled where it enters the hose. The plate *N* can be easily arranged so as to take in the round fitting used on the end of the hose secured to the train pipe.

Reading, Pa. F. M. ARTHUR.

Information Wanted.

Editors:

I notice a great many ten-wheel engines that have their eccentrics on lead driving-axle, and I want to know how such an engine could be run in case a strap, or pin was broken on front end of side rod? With the opposite rod taken down there would be no connection with the eccentric axle. I have put this question to a number of engineers but have failed to receive a satisfactory answer.

The above slip was cut from the *Locomotive Fireman's Magazine*. Will you please answer the question, and if there are any ten-wheel engines constructed with their eccentrics on the lead driving-axle, please say what make they are?

W. A. RHUTSMAN.
Hampden Junction, Ohio.

[Years ago Mason built ten-wheeled engines by simply adding on a pair of drivers behind his eight-wheeler, this, of course, meant that the forward axle had the eccentrics on it, but it was the main driver. We know of no ten-wheelers built with eccentrics on forward axle with main rod connections on center pair of wheels. There are many engines in use where the eccentrics are not on the main axle, the Elevated engines being all built that way. With such an engine, when side rods are taken down, be towed in, don't run with one side rod.]

Stretching Bolts that are Too Tight to Drive Out.

Editors:

I was somewhat amused to read that article of Mr. Charles' some months ago on "stretching" bolts that are to be driven out, thus making them smaller.

Suppose we take cylinder bolts in the frame fastening, one-inch bolts, and they are tight. We wish to drive them out.

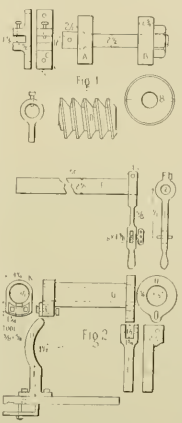
I find that a one-inch bolt is $\frac{11}{16}$ inch at the bottom of the thread. How much power would be required to stretch that bolt in the *fit* and *not* stretch in the threaded part?

St. Louis, Mo. JOHN ATKINS.

Driving Brass Chuck and Boring Bar.

Editors:

How nice it must be to work in or have charge of a shop where they have all new, improved tools, where the work can be got out quick, and, as you would think, with-



BORING BAR AND CHUCK FOR DRIVING BOX BRASSES.

out having to make any measurements, the machine doing all that simple operation. I have no doubt but this can all be done in a shop where all new work is put up and enough of it to pay for making a set of tools for each part of the job, but when it comes to repairing then all your standard sizes go, that is, in the average shop, for it is not in all shops that they keep standard sizes.

One night, after quitting time, I was walking down through the shop with a friend, and passed a 30-inch lathe with a driving box strapped to the face plate. He remarked "Is that the way that you bore driving boxes? Why don't you have a vertical boring mill? Then you could bore them while you are now getting them set."

This rather staggered me, as we think that in the matter of driving boxes we are pretty well up in the lead. From the time that a driving box is on the floor until the cut is started will never exceed five, and the average will not be two minutes, there must be some fast work done elsewhere, or my friend did not know how fast we work.

The following is our way of doing the job. The brasses are brought from store-room to the lathe, a 30-inch Pond. The mandrel, or chuck, for holding them is shown in Fig. 1. It is good and heavy, to stand lots of strain. The shaft is 2½ inches, and enlarged at the head, and collar *A* is shrunk on. Collar *B* is a nice fit, the outside diameter is ½ inch less than the size of brass, so that the brass can be set without running the lathe. *C* is the driver, bolted to face plate, the dog is made on purpose for this job, and just fits shaft, and point of set screw is let in ½ inch, so there is no slipping. *D* is a section of the thread. By making thread of this style you get the strength just where you want it. Make good big centers, almost size of lathe centers, then put in a brass.

Tighten up by letting the handle of the wrench come over on the carriage with the lathe just moving, then put in a tool and see if you can pull out the brass. You will find that the lathe will stop first.

The brasses are next marked and slotted, this being done on slotter held in chuck (described in May issue). We press our brasses in at five to seven tons pressure and then pin them, then plane the boxes and they are ready for boring.

The boring bar is 31 inches long, 1 inch at one end is ½ inch smaller to take the handle. The centers are good and large and "out," so that the bar is eccentric ½ inch. The handle is a good fit and has a projection at back to take set screw built so as to clamp it tight. This should be changed often, so that the centers will not wear out of place. In the handle is a slot ⅝ inch by 1⅛ inch to go over a standard that is bolted to ways *F*, Fig 2. The upper part of this is same radius as slot in handle on bar, the thumb screw is to hold it in any desired position. The sleeve *G* is of cast iron, with a collar of wrought iron on each end. The one marked *H* is to have holders to clamp in tool post and the hole should be slotted about ½ inch and should have ⅜-inch rivet through it. This is for the purpose of carrying sleeve *G* along on bar *E*. The collar *K* is for holding tool and is 1¼ inches wide and shrunk on, and is made as thin as possible on the back so as to go in a small brass, for by putting the eccentric towards back of lathe the tool will clear in a smaller hole than when it is set in front. The slot for the tool is ⅜ inch by ¾ inch and a plate over the outside bolted tight. The tool is held by a set screw. One thing, the center wants to be big so as to avoid all chance of pulling them out.

It may be thought and said that these bars are heavy and clumsy, and that you would have to have a crane to get them in and out of the lathe, but that is not so. That they are heavy is true, but not so much so but that one man can handle them quite easy, lifting them out and in alone, and there is no cut too heavy for them. While $\frac{1}{32}$-inch feed and $\frac{1}{16}$-inch depth of cut will suit an ordinary bar, this bar will go along just as lively with $\frac{1}{16}$-inch feed and ¼-inch depth of cut. If, after having set the tool, it is found that the cut is too deep, or that you could take more, just loosen thumb screw on standard *F* and raise or lower handle, as the case requires. This is the object of the eccentric bar, and two or more cuts can be taken out without loosening the tool. We think that this is a good bar, but would like to hear from some one who thinks they have a better, as mechanics ought never to be satisfied with what they have if there is a better.

W. A. ROBERTSON.

Cedar Rapids, Io.

Getting Out of the Rut in Air Brake Practice.

Editors:

Air brake men working on engine equipment do not seem to make it a rule to give the new brake valve of 1892 more excess pressure than the valve of 1890.

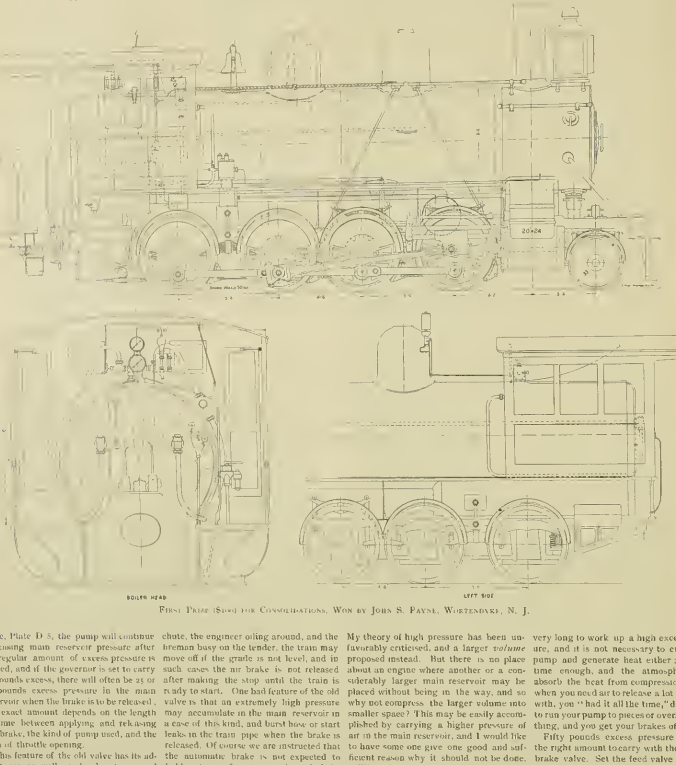
When the brake is applied with the old pressure, and no more air can accumulate in the main reservoir than the pressure at which the governor is adjusted; while with an excess pressure valve and the governor connected with train pipe, when I draw my valve handle from running position to service stop, the pump will start up and increase the main reservoir pressure. With an old three-way cock, the pump governor set at 70 pounds and connected with train pipe, an 8-inch pump, and 165 pounds of steam, I have seen main reservoir pressure increased to 83 pounds before releasing the brake, after making a "hurry up" stop for a railroad crossing.

While standing at a water crane or coal gines and jump off, leaving the brake set and pump working. After a while the brake leaks off, and the engine runs down against the one on the pit, causing great excitement in the neighborhood of the ash pit and sometimes cracking an outside banging brake beam and scraping the pilot bars. Then the boys give the engines a "roundhouse overhauling"—paint the scars with lamp black on oily waste. Another case of "air brake failure."

This new Westinghouse brake valve seems to be just what is required in handling the air brake on long trains, but its efficiency is increased or decreased by the amount of reserve pressure carried, rapidly. I have seen a portion of the pipe between the air pump and main reservoir *red* hot and neither gauge pointer reach 70 pounds, with a leaky train pipe, frequent stops and a heavy train; but it is not necessary to overheat anything.

If high excess pressure is carried, an 8-inch pump will give as good service as a 9½-inch pump, but with little or no excess. The pump is the main factor in releasing brakes on a long train after an emergency application, and the air must be compressed rapidly, necessitating a large pump and causing heating.

After 70 pounds of pressure is attained and the feed valve closes, it will not take



FIRST PRIZE ($100) FOR CONSOLIDATIONS, WON BY JOHN S. PAYNE, WORTENDYKE, N. J.

valve, Plate D 8, the pump will continue increasing main reservoir pressure after the regular amount of excess pressure is gained, and if the governor is set to carry 20 pounds excess, there will often be 25 or 30 pounds excess pressure in the main reservoir when the brake is to be released, the exact amount depends on the length of time between applying and releasing the brake, the kind of pump used, and the area of throttle opening.

This feature of the old valve has its advantages as well as disadvantages, and if the new brake valve with feed attachment is not allowed to carry at least 30 pounds of excess pressure, I would prefer that the feed valve be removed and replaced by an "excess pressure valve" made to fit the new brake valve, and let the governor be controled by train pipe pressure. In this way I could have more pressure to release my brakes with, because, with a "feed valve" the action of the pump is limited by the main reservoir chute, the engineer oiling around, and the fireman busy on the tender, the train may move off if the grade is not level, and in such cases the air brake is not released after making the stop until the train is ready to start. One bad feature of the old valve is that an extremely high pressure may accumulate in the main reservoir in a case of this kind, and burst hose or start leaks in the train pipe when the brake is released. Of course we are instructed that the automatic brake is not expected to hold a train after stopping it, and if the train will not stand, hand brakes must be set and the air brake released and recharged immediately, but engineers know that hand brakes are not used on the train equipped with air.

Down here, by the roundhouse, the track descends to the ash pit, and when there is an engine on the pit, the hostlers often set a couple of engines behind her on the pit track ready to have their fires dumped in turn. The boys frequently stop their en- My theory of high pressure has been unfavorably criticised, and a larger *volume* proposed instead. But there is no place about an engine where another or a considerably larger main reservoir may be placed without being in the way, and so why not compress the larger volume into smaller space? This may be easily accomplished by carrying a higher pressure of air in the main reservoir, and I would like to have some one give one good and sufficient reason why it should not be done.

When the automatic air brake does not release as promptly as it applies, it is an instrument of danger instead of a safety appliance, and when every car used in interstate traffic is equipped with air and all brakes used, it will be apparent that an ordinary main reservoir carrying but 20 pounds excess pressure is away short of the requirements.

Some say that the main reservoir and piping will heat under high pressure, so it may, if the pressure is pumped up too very long to work up a high excess pressure, and it is not necessary to crowd the pump and generate heat either; give it time enough, and the atmosphere will absorb the heat from compression, then when you need air to release a lot of brakes with, you "had it all the time," don't have to run your pump to pieces or overheat anything, and you get your brakes off, too.

Fifty pounds excess pressure is about the right amount to carry with the new D 5 brake valve. Set the feed valve at 70 and the pump governor at 120 pounds. I would suggest making a threaded hole in the path of the brake-valve handle spring just to the left of running position into this hole screw a stud that will prevent the handle spring from passing it, thus cutting out the full release position. In case of derangement of the feed valve, the stud may be easily removed and the handle carried in full release.

As the equipment of freight cars with air brakes increases, apparently new conditions arise, and the new brake valve is intended to meet those conditions. Its efficiency should not be restricted. But it is awfully hard for human nature to "get out of the rut."

Several years ago I fired for an old-time engineer, who laid off one summer and went Down East to visit the home of his youth When he came back, he told me a story that I shall never forget and never believe, but it has a "moral." He said that when he lived down there with the old folks, there was a big tree stump standing in the road and passing teams were obliged to turn out and drive around it, he remembered the exact place by the big rock over in the pasture. And he said it was actually the fact, that, although the stump had disappeared, the grass was growing over the spot nearly to the center of the "right of way," and teams were still turning out and following the ruts of thirty years ago

WILL W. WOOD

Terre Haute, Ind.

We have received a small, pocket-sized manilla-covered book known as the *Car Interchange Manual*, being an abstract of the decisions of the Arbitration Committee of the M. C. B. Association, and including cases from 1 to 237. This little work was compiled by Mr. J. D. McAlpine, of Cleveland, O., and is issued by the *Railroad Car Journal*, of this city, at 20 cents each. It is a very useful little work for car inspectors at interchange points.

Those Prize Designs—Consolidations.

The first prize for best arrangement of cab and boiler fittings for consolidation locomotives was won by John S. Payne, of Wortendyke, N. J., who also won the first prize for eight-wheeler. Cut of this design is shown herewith, its specifications are identical with those of the eight-wheeler illustrated last month, except in necessary detail. The arrangement of throttle stem and lever in this design was especially recommended.

SECOND PRIZE

There were far fewer designs to choose from for the consolidation engines than for the eight-wheelers, and there was very little that was new offered. The arrangement of cab fittings in this design were commended for the absence of cocks and pipes in the cab. The cocks are all located in a turret between the steam guage stand and dome, and the pipes lead from them directly ahead and out of the cab—for instance, the steam pipe to injectors.

A double check is used, an inside and an outside one.

The center window of the cab lets down, like a street car window, and the arm rest is carried on brackets far enough outside to avoid any movement of the windows. The arrangement of levers and handles in cab are very handy for the engineer, and the air pump is out of the line of vision.

This design was made by Willis E Holloway, (who is but 17 years of age) of McKees' Rocks, Pa. This young man is the son of a locomotive engineer, but states that he got no pointers about this design from his father. He has picked up what little he knows about drawing without instruction, and writes us that he graduated from one of the public schools in Pittsburgh on the day he got our check

His ideas seem to run in lines pretty well accepted as good, and if he keeps on, may accomplish the aim of his life—to be a mechanical engineer

THIRD PRIZE

The design herewith submitted exhibits more originality than any of the others, and only for the location of the air pump directly in the line of vision, the design would have taken second money.

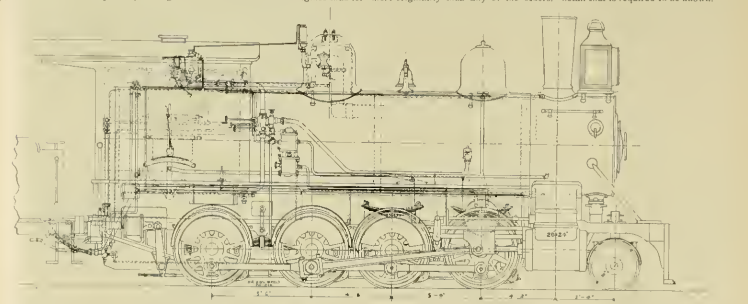
Every opening in the boiler is protected by a safety device, the checks are double—having an outside and inside opening valve.

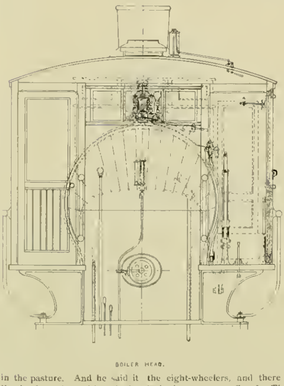
All the steam cocks, even the whistle, are tapped into a turret of special design, with a self-closing valve of peculiar construction. All the glass in ventilators, side windows and back doors is opaque, with wire mesh in it—to prevent breakage.

The engineer's valve is located on side of cab, and there are a good many special fittings of the designer's own ideas. The handholds on corner of cab, where they can be seen and reached from deck or the ground were highly commended.

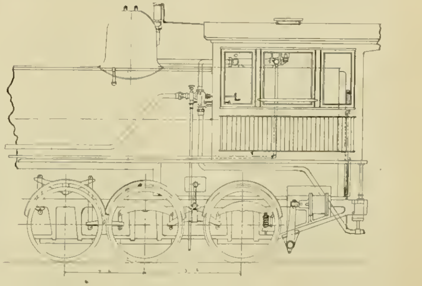
The winner of this prize is Mr. G. A. Akerlind, now employed in the drafting rooms of the Brooks Locomotive Works. He was born in Sweden 38 years ago, learned the mechinist trade and worked at it until 1879, when he entered the Technical School at Stockholm, where he studied for four years, and was then employed as draftsman until 1887, when he came to America He worked as draftsman in several shops, including the Brooks works, the P. R. R., Erie, Big 4 and the Rock Island, and has recently returned to the Brooks drawing office.

The drawings will furnish any other detail that is required to be known.





BOILER HEAD.



LEFT SIDE

SECOND PRIZE ($50) FOR CONSOLIDATIONS, WON BY WILLIS E. HOLLOWAY, OF MCKEES' ROCKS, PA.

Manning, Maxwell & Moore, of this city, have received orders for a 12 ton Shaw electric crane for the Pittsburgh Tin Plate Works, a 30-ton crane for the Worthington Pump Works, Brooklyn, and a 40-ton crane for the Midvale Steel Works, at Philadelphia. The makers of the Shaw crane can feel proud of these orders, and especially of the Midvale crane, as those works already have an 80-ton, two 40-ton, and two 20-ton Shaw cranes at work. It is only in the last ten years that most manufacturers have found out what a large part of the cost of production could be charged up to handling material, and the best of them are hunting for the most economical means of doing this work Who would build even a moderate sized shop now without a crane?

Committees for Conducting Discussion for the American Railway Master Mechanics' Association for Meeting of 1895.

No. 1. Exhaust Nozzles and Steam Passages—Continued—Robert Quayle, William Forsyth, James McNaughton, W. S. Morris, D. L. Barnes.

No. 2. Locomotive Fire Kindlers—Continued—John Hickey, J. O. Pattee, Geo. B. Brook, W. T. Reed, John A. Hill.

No. 3. Shop Tests of Locomotives—William Forsyth, A. S. Vogt, George Gibbs, D. L. Barnes, W. H. Marshall.

No. 4. Gauges for Sheet Metal, Tubes and Wire—Committee to confer with manufacturers and others, and to submit a practical system for adoption by the association—Geo. R. Henderson, T. W. Gentry, C. F. Thomas, A. W. Gibbs, Alex. Gordon.

No. 5. Utilization of Railroad Scrap Material—Report on best method of handling the same. H. J. Small, H. Monkhouse, Henry Schlacks, Geo. W. Smith, H. P. Robinson.

No. 6. Causes of Bulging of Firebox Sheets—P. Leeds, John Hickey, John Ellis, A. E. Manchester, G. H. Baker.

No. 7. Best Material for Boiler Tubes and Specifications for Same—T. A. Lawes, W. L. Gilmore, R. B. Reading, P. H. Peck, M. N. Forney.

No. 8. Pistons and Piston-rod Fastenings—With special reference to pistons of large diameter and light weight—R. H. Soule, W. H. Thomas, William Swanston, J. D. Barnett, C. Graham, Jr.

No. 9. Riveted Joints—To submit a set of proportions for riveted joints, representing most approved practice—A. E. Mitchell, S. Higgins, Geo. W. West, H. D. Gordon, L. R. Pomeroy.

No. 10. Wear of Driving Wheel Tires—As affected by weight upon same—W. H. Lewis, J. N. Barr, E. M. Herr, J. H. McConnell, Geo. F. Wilson.

No. 11. Transmission of Power—Report on relative merits of pneumatic and electric transmission of power in railway shops—T. B. Purves, Jr., John Medway, F. M. Twombly, C. E. Fuller, J. T. Gordon.

To Confer with American Railway Association—J. N. Lauder, W. A. Smith, R. C. Blackall.

Arrangements for the Meeting of the Traveling Engineers' Association.

The Committee of Arrangements have issued the following circular, which explains itself

The Committee of Arrangements for the second annual convention, to be held at Denver, Colo., commencing Tuesday, September 11, at 9 A. M., desire to submit the following information

Our headquarters will be at the Albany Hotel, corner of Seventeenth and Stout streets. Rates, $2 per day (American plan). All trains arrive at Union Depot, foot of Seventeenth street. Cable cars opposite depot pass the Albany Hotel entrance. Members desiring to stop at headquarters should engage their rooms in advance. The meetings of the convention will be held at the Elks Hall, 1515 Lawrence street. The general managers of all the principal railroads in the country were very thoroughly canvassed last year, and we do not think there will be any trouble about securing transportation for members and their families desiring to go to the convention if asked for in the usual manner. The Pullman and Wagner Palace Car Companies will make a one-half rate to members and their families to and from the convention. When traveling in Pullman or Wagner cars please note the following If traveling in a Pullman car buy a ticket to Denver, take a receipt from the agent that you purchased ticket of, and when you arrive at Denver take your receipt, together with your credentials, to the district superintendent located there, and you will receive a free pass for the return trip. If you travel in Wagner cars, buy your tickets both ways, taking a receipt for the same each way. Upon your return home inclose your receipts, together with your credentials, to J. A. Spoor, general manager Wagner Palace Car Company, 625 to 629 The Temple, Chicago, Ill., and one-half the money paid by you will be refunded. The Wagner cars are treated as Pullmans west of Council Bluffs, which feature please look out for, and take separate receipts to Council Bluffs and beyond. The credentials necessary for members to have to secure the reduced rates in sleeping cars, hotel, etc., is their membership certificates, reading good until September 1, 1894.

W. O. THOMPSON, *Chairman*,
R. MCVICAR,
T. A. HEDENDAHL,
MARTIN MONROE,
F. P. WILSON,
GEO. ROYAL, SR.,
P. H. SLACK,
Committee of Arrangements.

The Meeting of the Master Blacksmiths.

The next annual convention of the National Railroad Master Blacksmiths' Association will open in Pittsburgh, Pa., on Tuesday, September 4, 1894, and the sessions will continue Wednesday and Thursday. The indications are that the meeting will be exceptionally well attended and present many features of mechanical and social interest. Thus far there have been planned visits and tours of inspection to the various works in and about Pittsburgh. Among the papers contributed several give promise of unusual interest.

The Home Hotel, Dusquesne Way, between Eighth and Ninth streets, has been designated as the official headquarters during the session.

J. J. THORNTON, *President*. GEO. F. HINKENS, *Secretary*.

After Fifty Years on the Footboard.

There now lives, at Daytona, Fla., Mr. John G. Eckman, who has put in fifty straight years running a locomotive. Mr. Eckman was born in Philadelphia in 1821, became an apprentice to the P., W. & B. road in 1837, and in 1840 took out his first locomotive—the "Nicholas Biddle." He ran on Southern roads mostly until 1890, when he quit the Florida Southern on account of rheumatism, but is still employed by the company. In these fifty years Mr. Eckman has seen every improvement made in locomotives, and, it is claimed, was himself the inventor of the cab, the pilot, cylinder cock rigging, and other devices.

Mr. Eckman knows just what he has done, as he is one of the kind of men who "set things down." Since 1840 he has been the regular engineer of 118 locomotives from 19 different builders, on 21 different roads, and has made 1,350,000 miles

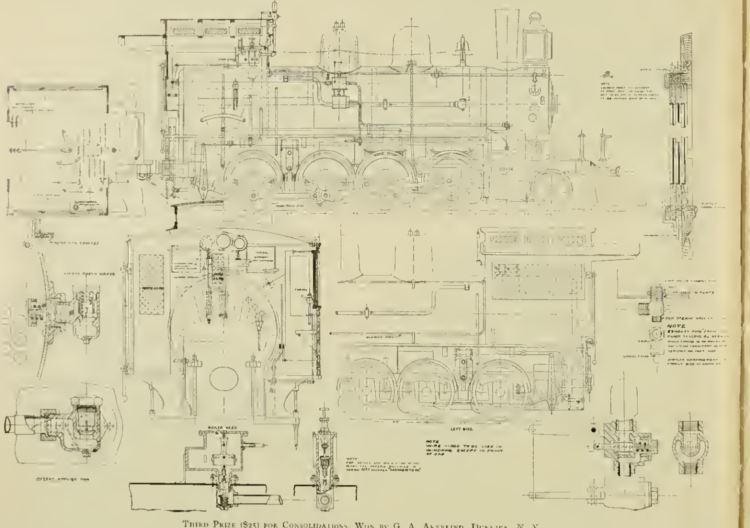
Mr. Eckman is now 73 years of age. There should be a pension fund for such as he they deserve it.

Something Neat.

The officials of the Western R. R. of Guatemala, C. A., gave their American employés a holiday on July 4th—with full pay.

Thirty-four of the exiles got together in Retalhuleu, had a parade with band, visited the U. S. Consul, the Government officials, and then partook of a fine dinner, tendered by an American hotel keeper. A vote of thanks was given Superintendent A. Tuit and Director-General A. Meyer, of the Compania del Ferro Carril Occidental de Guatemala.

We notice quite a number of railroad men who carry copies of the code of rules of car interchange that are a year or more out of date. This is bad policy, as the rules are modified and changed every year and new one are to be had at five cents each, and much cheaper in quantities.



THIRD PRIZE ($25) FOR CONSOLIDATIONS, WON BY G. A. AKERLIND, DUNKIRK, N. Y.

*Railroad Coppersmithing—X.

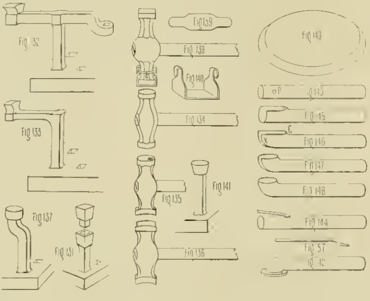
By John Fuller, Sr.

PLANISHING AND SMOOTHING.

We have been talking about planishing and smoothing, and it strikes me that there may be many of the boys who would like to have an explanation of what we mean by that, so they may be helped to fully understand the last two chapters. Planishing, as understood by braziers or light coppersmiths, is the art of first molding smoothly, or shaping the metal when first formed; second, hardening or closing the grain after the form is completed, and third, giving it, by the aid of a bright hammer, a finishing gloss or a kind of case-hardening sufficient to receive the final polish with tripoli, which is a very fine powder having a purple hue.

To planish or finish the numerous articles made by braziers and coppersmiths, it is necessary to have quite a variety of heads as near their curves as possible, and the square shank of the head should be taper enough to make it fit tight into the several tools, that is, the upright shank *B*, Fig. 131, the tea-kettle shank, Fig. 132, and the gibbet shank, Fig. 133, which receive it, the convex curves of the round heads may run from four inches to two feet or more, the long heads used for cylinders, about the same, and these are usually made twice their width in length or thereabout. It is also necessary to have a few bright saddle heads for such work as requires them. We had no bright mandrels, but later experience has taught me that they would have been better adapted to our use for many things than the little short heads we had. Our hammers were various; some with round and some with square flat faces, Fig. 134 (or they were commonly called so, though none were really flat), and ranged from twelve ounces to three pounds or more. The concave hammers, Fig. 135—that is, those with hollow faces—ranged from a circle of four or five inches to fifteen inches or more, and were used for spherical or ball-shaped work. The saddle hammer, Fig. 136, and those with long faces were used for such work as has been under consideration, such as bells, bodies, crowns, feet of domes, valve covers and chimneys. It is also necessary to have a number of bright bullet or convex-shaped hammers for special purposes, together with a bright anvil *A*, Fig. 131, and a bottom stake, Fig. 141. Now let us suppose we have heads, hammers and other tools suitable for a valve cover, Fig. 109, and we have the cover scoured with muriatic acid and salt clean and bright. We first take it to a mandrel or suitable long head, and smooth down all the irregularities with a clean smooth-faced mallet. Then take a flat-faced hammer, weighing, say about one and a half pounds, and commence at the beginning of the curve of the crown, delivering the blows in regular succession in a straight line, perpendicular to the top curve and the bottom flow, and then proceed in the same way, letting the blows lap each other a little at their edges as they are delivered until the course is completed all around. Now take it to a bullet stake, Fig. 137, and repeat the process as far as the stake will permit, and then on a head in an upright shank *B*, Fig. 131, finish up to meet the planishing previously completed on the bell or crown. Next give it a good rubbing down with a clean rag, so that the blows of the next course may be delivered between or on the edges of the last one and may be readily seen. If the article is to be cleaned up in a lathe two courses properly done are sufficient, but if it is to be finished complete under the hammer and then polished by hand, then, with a flannel wisp scour with sweet oil and tripoli, and after cleaning off carefully all oil and dust, look over the work and examine it well to find omitted spots and touch them up. Now take a spring-faced hammer, Fig. 138, or muffle the head with a piece of shalloon or a piece of skin parchment drawn tight over it, and go over the work lightly to finish. The spring-face may be changed from hammer to head according to the ingenuity of the workman and the necessity of the work in hand. The shalloon supplies the place of a spring-face, as also does the skin, their purpose being to take off or counteract the effect of the impact of the hammer, the impinging of which on a naked head causes a sharp ridge all around the blow, and this can only be obviated by the muffler inside or the spring-face outside. The concave and all other hammers may be fitted with false faces according to the work for which they are to be used.

The planishing described in the foregoing is for the best kind of bright work. The next grade is for common or brown work. This grade is carefully cleaned, and then before the planishing is commenced the article is covered with good Spanish brown, sometimes it is applied with a brush like paint, being mixed with clean water, at others it is put on with a dry tow wisp, well rubbed into the grain and applied so that plenty hangs on, but uniformly all over; it is then hammered into the grain the first course, and then smoothed and finished in the second. Another style of planishing is executed in a way that every blow may be seen distinctly and in regular succession, and is adopted in that kind of goods where closing the grain to stiffen or harden is the principal object in view, while in the rough kinds of braziery, such as carboys, sugar molds, pump heads, air vessels and various kinds of boilers, the hammering is done in a promiscuous way so long as the surface is covered and the work hardened sufficient to maintain its shape. The large pipes in ocean steamers are also planished in this way.



SPRING-FACE HAMMER.

A spring-face hammer is the constructing and substituting a false face for special smooth work, and is made and fixed to the hammer, as shown in Fig. 138. A piece of sheet steel of a suitable thickness for hammers, about 20 gauge, is cut as shown in Fig. 139, the two ends are then turned up as in Fig. 140 to fit the hammer face, the lugs being placed in a line with the handle. When fitted properly, harden and draw down to a good spring temper. Now lay between the hammer face and the spring face two or three layers of good French shalloon, which answers as a cushion, then bind the lugs with a stout piece of binding wire to the hammer, and turn the lugs down on the wire in such a way that they will tend to draw the spring face close up and tight to the hammer face. After testing and polishing it is ready for use, and will be found a valuable and effective tool where a nice smooth job is necessary.

SHORT BENDS.

In both locomotive and marine work it has often been found necessary to make a short bend of a special kind or to turn the end of pipes, when it is required to get the shortest possible turn that can be made so that a flange will set right down close on the straight part of the pipe, as in Fig. 142. In some shops I have seen this particular problem block the progress of work until some other means could be devised to accomplish the end in view, when perhaps, if all the workmen had been consulted, the way out of the difficulty would have been made clear, for among a gathering of a dozen men engaged in the copper trade there is almost always a stray brazier to be found who, if apt in the application of or in turning to account the methods acquired in youth, is usually the leader of the class. The principle upon which this bend is made is, among braziers, almost the first lesson to be learned, while among railroad coppersmiths it is about the last. I make this statement to call attention a little closer to the lesson, because this is an example where one means is adopted to obtain different though similar ends.

To make or turn this bend, Fig. 142, we proceed as follows. First, measure along the pipe a length equal to one-half the circumference of the pipe on which it is required to make the turn, Fig. 143, at the point *P* make a small hole large enough to admit the point of the burring pin easy, and with a round file round up the edge all around the hole carefully. Now take the steel burring pin, Fig. 57, having the point bent as shown, and make the pipe red hot about the hole, insert the point of the bar and jar it out with a hammer, as shown in Fig. 144, until there is a burr or turn *T* worked out as high as the flange is thick on the long parts; then slit the pipe down from the hole to the end, as in Fig. 145, and run out the seam at the back the same distance if it is a brazed pipe. If it is a solid drawn pipe make a hole at the back, or opposite side (without burring), and cut the pipe down as far as the hole and open it out, as in Fig. 146. Now flatten out the flaps, then with a radius equal to one-half the circumference of the pipe describe the curve at *X* and cut the flaps to it, as shown in Fig. 146, and from the line at *C*, where the burr or bend begins to turn, take 78.75° of the circle (as described in the formulæ and shown in Chap. III, Fig. 27) of which *X* is a part. Now thin the back edges of the flaps of the turn, Fig. 147, and work them over on a cod or some suitable bullet stake, and if large enough to need it, cramp it, then close the seam, as in Fig. 148, and finish by brazing. The method here described, as hinted above, is an adaptation or application in part of the brazier's manner of making the lower turn of a tea-kettle spout, and is among the first lessons to be learned by him; and while it is often necessary to make a short turn of this kind in both locomotive and marine work, the method is not general, and when it happens that workmen do not know how to make this turn, a casting has to take its place at a much greater cost and perhaps inconvenience.

BRAZING FLANGES.

The brazing on of flanges, large and small, has caused as much or more objectionable language to be uttered than almost any other operation usually performed in a coppersmith's shop, owing principally to the want of a little knowledge, or the possession of an inquiring mind, sometimes, too, owing to the greed of a manufacturer, who wishes to palm off flanges for pure copper that will not bear enough heat to run the spelter. This necessarily entails much trouble and annoyance to the workman, and not a little loss to themselves, because the extra time spent and liability of failure, together with the extra material consumed with the failures, more than balances the advantage to be gained by the use of spurious metal. In speaking thus, I do not wish it understood that pure copper is the best material from which flanges can be made, for the best flanges the writer ever operated on were cast from a mixture composed of one pound of old copper and one pound of old brass tubes—which reduced to its elements would make the flange about sixteen parts copper and three of zinc—this makes the flange stiff and close grained, and much better for general purposes than pure copper. Having a good flange provided, the next thing is to have it properly prepared while at the lathe, the only thing, however, that concerns the coppersmith is the hole into which the pipe is to fit. This should be tapered one-eighth inch so that it will drive on tight, the end of the pipe being reduced that much. On the face side a one-eighth countersink should extend into the hole one-fourth of its thickness. When the flange is eased on the end of the pipe, and the pipe is through a short distance, drive it back with a blunt-pened hammer into the countersink, turning it over a little toward the face of the flange. It is now ready so far for brazing, but before taking it to the fire, if the pipe is small, it is sufficient to stop the opposite end of the pipe with a ball of waste or a wooden plug, so that the heat cannot run up through the pipe. Around the countersink of the pipe, which is through the flange, rub some soft fire clay that is about the consistency of thick cream, and brush a little on up the seam if it is brazed pipe. It is now ready for charging with solder and the fire. Flanges for large pipes are bored in the same way as small ones, but it is necessary to take a little more precaution in preparing for the fire, so that the heat does not run up the pipe. In this case take a disk of light sheet iron about three or four inches larger than the diameter of the pipe, and clip this disk all around with the shears, at intervals of about an inch; now turn the edge up, forming a kind of pan, Fig. 149, the places clipped acting as a spring to hold it fast in position. The pan is crowded into the end of the pipe about four or five inches from the flange, and some soft fire-clay is plastered in the cracks of the pan all around the edge, and also around the edge of the countersink of the flange. The edge of the fire-clay should be an inch or two above the flange, or above the thickness of it, and all arranged so that no flame can go up the pipe. See that the seams of the pipe are well covered with clay far enough beyond the upper side of the flange where the solder is to lay. Now sling the pipe so that the flange hangs level, and it is ready for charging and the fire. If the flanges

*Copyrighted by John Fuller, Sr., Seneca, Kan. These articles commenced in September, 1893.

appear to be of doubtful metal, try the quality before putting them on the pipe, by trying to run a portion of the spelter you have on the flange first. If it prove, as was suspected, that the solder will not run on the flange, it should be rerun—that is, remade. To do this, take one pound of the spelter and melt it and add one ounce of zinc while it is in a state of fusion, stir, and when cool enough to char a hazel stick, place it in an iron mortar, previously made about the same heat, and break it up again. Try it on the flange as before If it still takes too much heat or more than it is thought the flange will bear, lower it again with zinc, until it runs at a low enough temperature to preserve the flange and there appears no danger of failure. Never use what is called black solder or spelter, it is only employed by those wanting a sufficient knowledge concerning spelters or solder suitable for their work, neither be tempted to add tin under any circumstances if good work is desired.

The Elements of Boiler-Making—VI.

SHEET-IRON WORK.

By C. E. Fourness.*

How to Build a Snow Plow.

As the time of the year is approaching that snow plows must be prepared for business, I think it will be to the point to treat some on that subject. But judging by the tone of our Editors in regard to wedge plows, their (the plows') life is short, but boiler-makers will be called upon to make a great many still, especially for lines that only have an occasional bad winter, as under those circumstances a company would hesitate to tie up so much money in a machine plow I consider it a very nice job to lay out a plow right, especially when the sweep is different at the back than at the front. Although this first plow given will be made the same sweep the whole length, and it will be a pilot plow, layed out so it can be cut to fit the beam of the pilot, and the hole for the draw-bar to work through, also the holes for the braces (that is the difficult braces to get at), these are to be all cut and punched while the sheet is straight, before rolling, as it can be handled so much more conveniently.

Generally in building a pilot plow, if any thing is laid out it is the hole for the draw-bar beside the front and back, so after it is bolted together it is placed as near as possible in position, then the man on the job marks off what he thinks will be necessary to cut off to clear the beam of the pilot

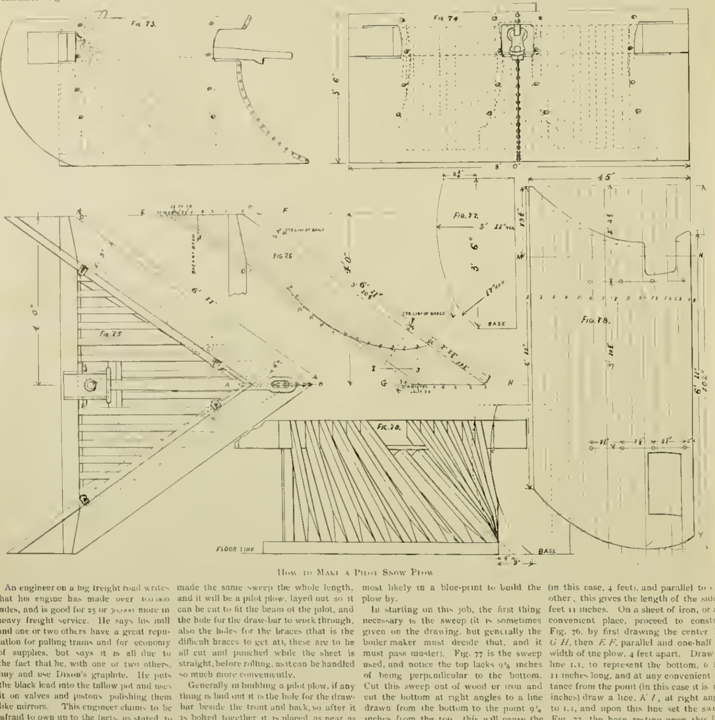
He then takes it apart and punches it if he can, but generally cuts out the piece by hand, after which he tries it again, marks and cuts off a little more. He, perhaps, repeats this operation three or four times before it goes back to place, and then, if it fails to fit properly, he will, perhaps, jack up the helper for not getting it back equal when he marked it off

By laying this all out on the straight sheet, it takes but very little longer for the layer-out, and then after it is fitted together all that is required is to shove the plow back to place and fit the braces. Fig 73 is a side, and Fig. 74 is a front, elevation of a pilot, with a snow plow attached. These views show the appearance when ready for use and are, with the top view or plan (Fig 75), the views that would be given most likely in a blue-print to build the plow by.

In starting on this job, the first thing necessary is the sweep (it is sometimes given on the drawing, but generally the boiler maker must decide that, and it must pass muster). Fig. 77 is the sweep used, and notice the top lacks 9¼ inches of being perpendicular to the bottom. Cut this sweep out of wood or iron and cut the bottom at right angles to a line drawn from the bottom to the point 9¼ inches from the top, this will cause the sweep to stand in the correct position when set upon the base, as shown in Fig. 77. When the sweep is ready, set the pilot on a level part of the floor, if the bottom of the pilot is to be level with the bottom of the plow. Some prefer to have the plow project below the pilot, if that is desired, place strips of wood the thickness required under each corner of the latter to bring it into the required position. That attained, it is necessary to find the length and angle of the bottom line or edge of the plow, this is found by setting the sweep up to the pilot into the position the plow will occupy when in place, as shown in Fig 79 The sweep in full lines being the back end and the bottom is 9 inches from the base of the pilot, at which point make a mark. The sweep in position at the front is shown in dotted lines, and the bottom is 4 inches from the base, at which point also make a mark.

In order to find where these marks are located along the side, see Fig 75 (of course, in working at the pilot, looking at the side of the sweep is Fig. 79, and looking down at the sweep is Fig. 75), and through these marks draw a line which will represent the bottom edge of the plow and give the angle required, next draw the center line *A B*, Fig. 75, then *C D*, one-half the width of the plow apart (in this case, 4 feet), and parallel to each other, this gives the length of the side 6 feet 11 inches. On a sheet of iron, or any convenient place, proceed to construct Fig. 76, by first drawing the center line *G H*, then *E F*, parallel and one-half the width of the plow, 4 feet apart. Draw the line 1.1, to represent the bottom, 6 feet 11 inches long, and at any convenient distance from the point (in this case it is 10½ inches) draw a line, *K I*, at right angles to 1.1, and upon this line set the sweep, Fig 77, the base resting upon this line and the bottom point to the line 1 1, draw the curved line to represent the sweep and space this into fourteen points, number them from 1 to 14. (Remember, as stated, it is immaterial how many points a line is divided into, the only thing the closer together the greater the accuracy). Draw ordinates through these points, keeping

* Foreman Boiler-maker, C., M & St. P Ry, Dubuque, Iowa



How to Make a Pilot Snow Plow

An engineer on a big freight road writes that his engine has made over 100,000 miles, and is good for 25 or 30,000 more in heavy freight service. He says his mill and one or two others have a great reputation for pulling trains and for economy of supplies, but says it is all due to the fact that he, with one or two others, buy and use Dixon's graphite. He puts the black lead into the tallow pot and uses it on valves and pistons polishing them like mirrors. This engineer claims to be afraid to own up to the facts, as stated, to his master mechanic, and wants his name kept out of print. Is it the M M. that he is really afraid of? If it is—what for?

In the testing department of Sibley College, Ithaca, they have recently broken steel wire which showed the enormous tensile strength of 180,000 lbs. to the sq. inch.

them parallel to the line 1.1; number these ordinates 1, 2, 3, 4, 5, etc., to No. 14, being very careful in numbering, as the top ordinates come back among the others after getting over the highest point in the curved line or sweep.

Notice, an opening must be cut on each side of the plow to allow the beam to pass through to let the plow go back to place upon the pilot, consequently find the distance that the beam is back from the point and draw an outline of the end, as shown in Fig. 76, draw also the line *I J*, Fig. 76, 4½ inches from and parallel to the center line; this is the width of the opening on this side and one-half of the opening required to allow the business end of the draw-bar to protrude.

Now for the sheets. Fig. 78 represents one side; for the two sides, this will require two sheets, 45 inches by 102 inches—the thickness is optional, generally $\frac{3}{16}$ inches. First draw a line, *M N*, Fig. 78, 19½ inches from the end of the sheet, at right angles to the side of the sheet intended for the bottom; space off this line into fourteen points, with the dividers set same as used to space the curved line in Fig. 70, beginning at the bottom, and number them from No. 1 to No. 14; draw lines through these points the full length of the sheet and parallel to the bottom, or line 1.1. Set the trams from the center line *G H* to the line *K L*, on the ordinate No. 2, Fig. 76, and convey this length to the line No. 2, Fig. 78, measuring from the line *M N*. Set the trams again to the distance between the lines *G H* and *K L*, Fig. 76, on the ordinate No. 3, this length convey to the line No. 3, Fig. 78, measuring from the line *M N*. Convey the lengths of all the ordinates in Fig. 76 to the corresponding numbered lines in Fig. 78, being very careful when transferring the lengths of the ordinates Nos. 12, 13 and 14, or the ordinates for the top, that the right ones are taken. Make a center punch-mark at each of these points of intersection, as the sheet will flange to these marks, and after allowing 1½ inches outside of these marks for the flange, that end is finished. For the back end, measure the full length from 1 to 1 on the No. 1 ordinate, Fig. 76 (in this case it is 6 feet 11 inches). As the sides of this plow are formed of one sweep the whole length, each one of these ordinates are the same length; all that will be necessary will be to convey this length to the lines Nos. 1, 2, 3, 4, etc., to No. 14, Fig. 78, measuring from the center marks for flanging on the front end and making a mark at the back end to correspond with the length of the ordinates, then a line drawn through these points of intersection will be the line for shearing at the back end. This completes the outline.

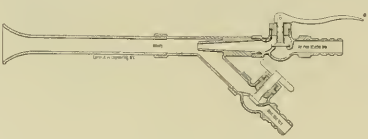
To find the opening required for the pilot and bumper beams. When the sweep is placed in position at the back of the pilot, mark the width of the beam and the height from the floor on the sweep as shown by the darts in Fig. 70, leaving at least one-half inch of clearance above and below the beam. I then find by laying the sweep on Fig. 70, in the position it occupies when drawing the curved line, that the width of the opening is from one inch above the line No. 10 to the line No. 13, inclusive, consequently set the trams to the distance between the line *K L* and the line forming the front of the pilot beam, Fig. 70, on ordinate No. 10, having this length, convey it to Fig. 78 and make a mark that distance from the line *M N*, on line No. 10, convey the length of the ordinates Nos. 11, 12 and 13 in a similar manner to Fig 78, and a line drawn through these points of intersection will be the line to cut for the front of the beam. For the back find the distance in Fig. 76, from *O*, the front, to *P*, the back of the beam; this will be the distance that the front and back lines for cutting will be apart, as the front and back of the beams are parallel. Next draw a line one inch above and parallel to the line No. 10, and between the front and back lines, for cutting, as the bottom of the opening comes one inch above the No. 10 line.

For the draw-bar hole find the standard height of draw-bars on the cars, and measure and mark this length on the sweep, Fig. 77, measuring from the base after deducting the height the pilot stands from the rails; this will be the height of the center of the hole, and as the hole in this case is 9 inches square, measure and mark 4½ inches above and the same below the center just found, and find that the bottom comes one-half inch above the No. 10 point, and the top one-quarter inch below the No. 13 mark, at which points draw lines parallel to No. 10 and No. 13 lines. Set the dividers from the lines *G H* and *I J* on ordinate No. 10, Fig 76, this length measure off on the lines Nos. 10, 11, 12 and 13 (as all these ordinates are the same length), measuring from the center marks for flanging, then a line drawn through these marks just found, and the corners rounded out a little for appearances principally, that part is finished.

The holes for the braces are on two lines, at right angles to the bottom; the front one is 2 feet 2½ inches from the point, the back one is 3 feet 10½ inches from the front brace. The holes are placed—the first hole 2 inches from the top, the others 8½ inches apart respectively. This completes one side ready to shear and punch. After this is accomplished use this sheet for a pattern for the other side by just turning it over when marking off the other sheet. After the sheets are rolled, the front end requires to be flanged, and I always found it better to start at the bottom, at the long point, and to heat the sheet just to the center marks and no further, as when heated beyond, I always found, it was much more difficult to work, and to ascertain when it was flanged enough, sight over the end from the top, as notice in the plan or top view, Fig. 75, looking down on top of the plow it is possible to see when the flange presents a plane surface. In fitting the ends or points together I usually mark off the holes on the right side and punch them, then set the two sides together at the point beginning at the long end at the bottom, which when set nice and even, hold with tongs while punching a hole with a screw punch at the point, into which holes put a temporary bolt to hold this part and change the tongs higher up, then set about 10 inches of the flange nice and even and punch a hole or two more for bolts; punch these holes some distance apart; move the tongs and set some distance more of the flange, punch more holes and put bolts in the holes to hold the point in place, and proceed in the same manner until the top is reached, then go back over it and punch all the holes; then the plow is ready to set in place on the pilot, to fit the braces, etc.

There are a great many methods in vogue of attaching the plows to pilots. I will leave the braces to the judgment of the builders, but the plow shown will require more braces before going to work at a snow bank, although what makes an excellent brace is a plate of perhaps $\frac{3}{8}$-inch thick iron flanged along one side to suit the curve or sweep at the bottom of the plow, the flange to be about 8 inches long and riveted to the plow, the flat part to extend under the pilot and to be bolted fast.

The advantage of this brace is that it makes the bottom edge so nice and strong, that part generally giving out first from striking against obstructions of different kinds. There is one matter I wish to mention; that is, it is immaterial what sweep is used, or in what position the sheets stand as to being vertical. If the sweep is the same the whole length, and the method shown is followed, the results will be all satisfactory.



Paint and Sand Distributor.

Painting, Sanding or Whitewashing by Compressed Air.

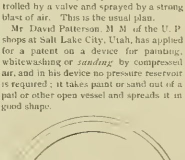
For some three years they have been whitewashing shops on the Southern Pacific at and around Oakland by compressed air. The apparatus used was mentioned in this paper, and the plan adopted by several roads for painting and whitewashing.

The Erie, for instance, are painting their freight cars now with a nozzle and without a brush. Much of the painting and kalsomining done at the Fair buildings was done with air.

Many have asked for details, but we have never been able to show anything special.

The liquid must be confined in an air-tight tank capable of sustaining the pressure of air carried, the air inlet pipe merely enters the top of this tank, the paint or liquid hose is connected to a pipe that reaches nearly to the bottom. The pressure forces the liquid up where it is controlled by a valve and sprayed by a strong blast of air. This is the usual plan.

Mr David Patterson, M. M. of the U. P. shops at Salt Lake City, Utah, has applied for a patent on a device for painting, whitewashing or *sanding* by compressed air, and in his device no pressure reservoir is required; it takes paint or sand out of a pail or other open vessel and spreads it in good shape.



Wheel-Handling Jack.

As will be seen by the sketch, his device is a small affair, requiring only hose connections for air and paint.

Valve *B* controls the flow of material, be it what it may, and the lever valve admits air, causing the device to operate, slow up or stop, without other manipulation than moving the lever. It is a jet apparatus, the air passing out of nozzle *A*, causing a strong suction on the connecting pipe below it.

In operation strained paint is used, the operator stands about six feet from the object to be painted and goes through the motions of handling a paint brush, with the nozzle.

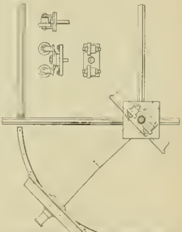
This manner of painting cars and buildings has many advantages over the brush; it drives the paint into every crack and check where a brush could not possibly reach; for shingled roofs it is particularly efficient. In applying sand it is just as efficient; they merely disconnect the paint hose and put on a slightly larger hose three or four feet long, and it takes the sand out of a pail, distributes it evenly and forces it into the paint.

All freight cars at Salt Lake are painted with this device; they paint a 60,000-lb. box car in fifteen minutes and a flat car in eight minutes. One man can paint as many cars with this device as fifteen men can with brushes. The only limit to the speed seems to be the agility of the operator. The paint is in the form of mist, but if valve *B* is opened, the paint will flow fast enough to flood the work, no matter how fast the operator moves.

Jos. McConnell, superintendent of motive power of the U. P., has recently ordered an engine fitted up with two pumps to supply air, and she is now out on the road with the paint cars, painting station buildings. With this device the painting up of an ordinary station is the work of hours where it was formerly days.

Used as a sand distributor for painted roofs etc., it is excellent and is as well a powerful sand blast, frosting panes of glass in a minute or so of work.

This is one of those simple inventions that do a lot of work and save a lot of expense, themselves costing less than they can save in a day.



Substitute for Turn-Table in Wheel Shop.

Two Handy Tools for the Car Shops.

At the Cedar Rapids shops of B., C. R. & N., they use the two tools shown herewith and their value can be seen at a glance.

The first device consists of a stand and lever; the fulcrum of the lever is swiveled in the head of the stand, as shown, and the short end of the lever has a V piece on it for taking hold of the axle. With this device two men can turn a pair of wheels around, switch them on to other tracks, or place them on tracks at right angles to the ones they are on with the minimum of effort.

The second device is a cheap and efficient substitute for a turn-table in car shops.

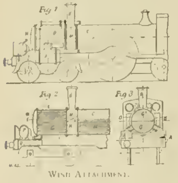
A pair of rollers, *P P*, are hung in a forked casting which swivels on a plate fast to a floor timber. These rollers are set flush with top of rail and a pair of wheels are run along the track until one wheel drops between the rollers. A curved rail is laid, as shown in the sketch, and it is an easy matter for one man to turn a pair of wheels as shown.

This device leaves the main track practically unbroken for the movement of car , as the little roller turn-table can be picked up and a short rail section dropped into its place

A Wind Attachment.

From London *Engineering* we take this little cut and description of a recent English patent on locomotives, which goes a great way toward proving that all the monstrosities in locomotive design do not come from this side of the big slough.

"The invention was patented by J. Musgrave and G. Dixon, Bolton, and E. Field and F. S. Morris, London. This invention has reference to means for heat-



WIND ATTACHMENT.

ing air in locomotive engines in which both hot air and steam are used in the cylinders. The engine cylinders *A* are provided with admission valves for heated air. Upon the frame *B* in front of the boiler *C* is mounted the heater, which comprises a shell *D*, tube plates *E*, *F*, tubes *G*, *G*[1], and end cover *H* inclosing the space *I*. A horizontal diaphragm *K* partly separates the space traversed by the tubes *G* from that traversed by *G*[1]. A diaphragm *L* is arranged in the smokebox *M* above the ends of the highest of the boiler flue tubes *N* and above the highest of the heater tubes *G*, so that hot gases leaving the smokebox from the boiler tubes *N* pass forward through the lower set of heater tubes *G* into the space *I* and thence to return through the upper tubes *G*[1] into the smokebox above the partition *L*, from which they escape through the chimney *O*. A blower *P* is fixed upon a platform *Q* in front of the heater, and driven from a moving part of the locomotive. The cold air delivered by the blower passes to the rear end of the upper space, and returns by the lower one, when it passes in a highly heated condition to the engine cylinders, in which it is utilized with steam."

A Secret Drawer on a Locomotive.

A London paper states that a singular adaptation of the locomotive has just been made in Russia. Information having been given to the authorities at Alexandrovo, on the Polish frontier, that the locomotive of the express leaving that station for Warsaw had been ingeniously converted into a receptacle for smuggled goods, it was carefully examined during its sojourn at the station. Though nothing was found wrong, it was deemed advisable that a custom house official should accompany the train to its destination, where the engine furnace and boiler were emptied and deliberately taken to pieces. In the interior was discovered a secret compartment containing 123 pounds of foreign cigars and several parcels of valuable silk. Several arrests were made, including that of the driver, but his astonishment at finding the engine to which he had so long been accustomed converted into a hardened offender against the laws was so genuine that he was released and allowed to return to his duties. The receptacle for smuggled goods was fitted into the bottom of the smoke box, which was made with a double bottom.

? A. What You Want to Know. ? A.

Don't ask questions that simply require a little figuring to determine; make each question separate. No notice taken of anonymous questions.

(121) B. H , Birmingham, Ala , asks

What causes the humming or drumming noise in locomotive fireboxes? *A*.—Supposed to be caused by many miniature explosions due to a certain admixture of air with the gases.

(122) W M T., Bristol, R I., asks

1 Who built the "999"? *A*.—The N Y Central Railroad. 2. What is her fastest speed? *A*.—We do not know; it is claimed 112½ miles per hour. 3. What English locomotive is the fastest, and what is her speed? *A*.—We do not know. As long ago as 1848 English engines were built that made over eighty miles per hour. We doubt if they have any that can exceed this now.

(123) T. C. L., Horton, Kan., asks

What engine got prizes at the World's Fair? *A*.—All builders who entered their engines for competition have received notice that they will receive a medal and diploma, the medals are to be all alike and the diplomas to state for what points the prizes are given. Two builders, the Cooke Works and the Richmond, did not enter their engines for competition and will not receive the medals. They will be rather an empty honor anyway, all medals are.

(124) J B. G., Chicago, Ill , writes

Our foreman and myself had a dispute to-day. I was making a hand-hole plate of the usual shape, longer than wide, each half, if separated the shortest way would be exactly alike, and I referred to it as an *oval*. He said it was not an oval, but an *ellipse*. I said an oval and an ellipse were one and the same thing. He said they were not. I bet him a hat, the question to be left to you. Who buys that hat? *A*.—You do. An ellipse and an oval are very different. Oval is derived from the Latin, and means egg-shaped, larger at one end than the other. In an ellipse the two ends are symmetrical. Look in your dictionary.

(125) J. H , Pine Bluff, Ark , writes

Please work the following problem by trigonometry or geometry, as the case demands. Required, sine, cosine in inches for any degree on any circle, say 10 degrees, 2-inch circle. *A*.—We do not work out mathematical problems, but try to point out a way for self-help or the information. Consult any engineer's pocket-book or mathematical work on plain trigonometry, where tables giving sines and cosines for any degree are given for one sized circle, from which any size can be figured easily. Every man who requires to know the answer to such a question should have Haswell's or Trautwein's Engineer's Pocket Books, or both.

(126) H. A. H., Brainerd, Minn., writes

I understand that the temperature of minimum friction in Fahrenheit degrees = 15 × √ velocity in ft. per min. but for any point above the minimum at present I am at a loss to know. Therefore I would ask what temperature would be obtained at a brake shoe, the shoe having a pressure of 1,825 pounds upon a 30-inch wheel, and the wheel revolving at a velocity of 2,190 ft. per minute, the wheel to run thirty minutes with this pressure applied, wheel and brake shoe to be of cast iron. If a steel tired wheel was used with a cast iron brake shoe, what would the difference in temperature be? *A*.—We cannot answer this question, perhaps some of our subscribers can. We only wish to tell where the information can be had, not to work out mathematical problems.

(127) J. B. P., Jimulco, Mex , asks

1. Is it possible to siphon water from a lower to a higher level? *A*.—No. 2. What is the principle governing action of a siphon? *A*.—The siphon is a bent tube, one leg being longer than the other. By filling the entire tube with liquid, or by exhausting the air from it, the pressure of the atmosphere forces the liquid up the short leg to the bend, where it runs over, filling the longer end. The weight of water in the long end causes a continuous flow until the vertical height of the two columns are equal. The atmospheric pressure is essential to support the column of liquid to the top of the bend, and varies with the density of the liquid. At sea level it is possible to siphon water from a depth of 34 feet for short end of siphon, while mercury can be siphoned less than 30 inches.

(128) J. F. B , Shamokin, Pa , writes:

We broke a rocker arm, lower end, could not get pin out of top, or valve stem, blocked crosshead after taking down main rod; *guessed* the center of seat in placing valve, and clamped it there by jamming the stuffing box. My engineer says this was not the right thing to do. Please say why. *A*.—You do not say what means you employed to prevent the link striking the broken end of rocker arm, and so moving your valve stem. As far as "guessing" the center of the seat, there is no difficulty at all in guessing right. When the rocker is straight up or perpendicular the valve will cover the ports, by pulling clear back, marking the stem, pushing clear ahead and marking again then dividing these marks and placing valve between them, you are safe, the valve could also be placed by guess, and tested by using a little steam to see which cylinder cock, if any, it came out of, if out of neither, the valve would be near enough in the center to cover ports.

(129) Queenslander, Maryborough, Australia, writes

As I have had some very strong arguments with some of my fellow workmen, I wish to ask you a question through the columns of your valuable paper, and to make myself understood, will explain that we have two classes of engines, one I shall call A, the other B. A engine has a rocking shaft with one arm up the other down, and the eccentrics follow the crank as it were—as you bring the lever to the center of the quadrant you increase the lead of the valve when running. Now, engine B has a rocking shaft with both arms down, or on one side the eccentrics in this engine lead the crank. Now, do you increase the lead of the valve in bringing the lever back to the center the same as engine A? I say no. Am I right or wrong? *A*.—You are wrong. In every arrangement of the shifting or Stephenson link the lead increases as the lever is "hooked up." If you were ordered to increase the lead on either of those engines, A or B, you would *advance the eccentric or the axle*. In hooking up you do not do this, but you move the center line of the valve motion itself back on the axle and eccentrics. If you draw a line across the strap and eccentric of one of these engines, and then move the eccentric ahead, the mark on the eccentric will advance ahead of the one on the strap, if, instead of moving the eccentric you hook up the lever, the mark on the strap will move back of the one on the eccentric. If the valve was set line and line with the port, either of these movements would admit steam to the cylinder, and would be increasing the lead. Your class A is an *indirect* motion engine, your class B a *direct* motion engine, and the lead increases on each of them when you hook up.

(130) Laurence B. Melville, Vicksburg Miss., asks:

1. What decimal part of an inch per inch would you allow in making a shrinking fit of steel tires to driving centers of wheels from three to six feet in diameter? *A*.—One eightieth of an inch per foot is the usual practice. The American Railway Master Mechanics' Association have adopted the following standard sizes for wheel centers and allowance for tire shrinkage

Size of wheel centers	Bore of tire less for shrinkage
38	0.040
44	0.047
50	0.053
56	0.060
62	0.066
66	0.070

2. Where can I get a New York air-brake instruction book? *A*.—Of the brake company. 3 Please recommend to me books on locomotive construction, repairing, etc , to be used by one whose only "motive power" is himself. I have Sinclair's latest. Also recommend what you think is the best book of mathematics to be used by a student. *A*.—"Myers' Locomotive Construction." You had better take a course, by mail, in the correspondence school of mechanics, it is a first-class thing. 4 Please give me an idea how to lay off a quadrant; know how to set valves. *A*.—Quadrants are usually cut full of notches from end to end. If certain points of cut-off are wanted it is usual to put up quadrant without notches, lay out the notches by setting the valve at the position wanted, then marking the quadrant. 5 Please give a rule for finding the length of an arc, any arc, from end to end, around the curved line? *A*.—We do not work out examples in mathematics. Consult any engineer's hand-book. See Haswell's pages 260, 261.

Trying to Put Water in a Red-Hot Boiler.

An inspector belonging to the Hartford Boiler Insurance Co. had a curious experience, which throws light upon the kind of men who are often to be found in charge of steam plants. His story, as told in *The Locomotive*, is both amusing and edifying. He reported

"I called to make an inspection at a stone works here, where they have two boilers, but use only one at a time. The engineer was working at his two pumps, which he could not get to throw water, and was scolding because he had no steam to run with, although he had had plenty only a short time before. The tubes in the boiler I was going to inspect were badly choked, and in fact nearly filled with soot from the coal. I thought that might be the trouble with the boiler they were using, so I opened the front of that boiler and looked into the tubes. They were red-hot. I looked for the water. It was gone. I looked under the boiler to see the fire, and jets of burning gas were actually spurting out between the rivets on the seams over the fire. And the engineer was still working at his pumps, trying to get some water. I had a queer feeling just at that instant. I got the engineer away from the pumps as soon as possible, and had him draw the fire, and I could see the gas burning along the seam while the fire was being drawn. As soon as it was darkened in the arch a little, I could see that the sheet on the bottom of the boiler was red-hot for a space about three feet square. As soon as the boiler cooled down we opened the manhole, and found the inside to be bone dry. The outcome was that the seam next to the bridge-wall was badly fire-cracked and sprung, so that a new sheet had to be put in. The tubes all had to come out, and all the seams on the fire surface had to be recalked, which I consider to be a very fortunate escape."

OUR ENGRAVINGS.

Of late we have had a great many inquiries as to who made the fine half-tone plates shown each month in LOCOMOTIVE ENGINEERING. Credit is due the expert anywhere and we are glad to recommend the engravers of our plates to those wanting good work at reasonable prices. All the half-tones and reproductions we use are made by the STAR ENGRAVING & PRINTING Co., 607 & 609 Sansom St., Philadelphia, Pa.

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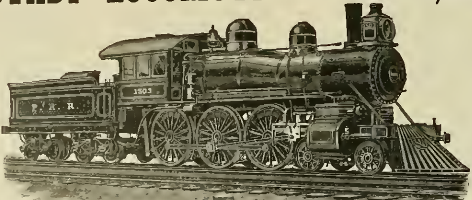

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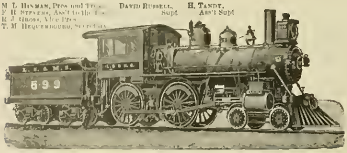

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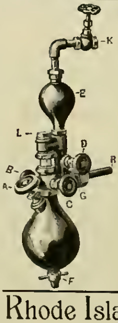

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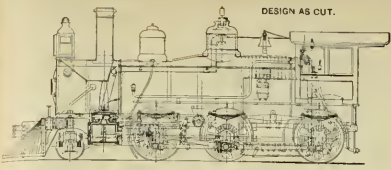

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Cylinders 19" x 24", driving-wheels 56" diameter; tires, 3" thick; total wheel base, 23' 6"; driving wheel base, 15' 5"; weight in working order, 109,000 pounds; weight on driving wheels, 91,000 pounds; boiler 60" in diameter; fire box, 73½" x 34⅛"; flues 246 in number, 2" diameter, 11' 6" long; chilled plate truck wheels 30" diameter; tender of 3500 gallons capacity, 33" chilled wheels. Engine is fitted with Detroit sight feed lubricator, Columbia metallic packing for piston rod and valve stems, balanced slide valves; two No. 9 injectors, headlight, asbestos cement lagging, New York air brake on driving and tender wheels, with train connections, National hollow brake beams, Gollmar bell ringer; and all necessary tools.

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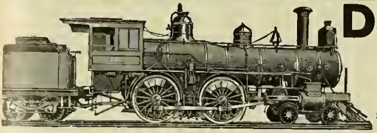

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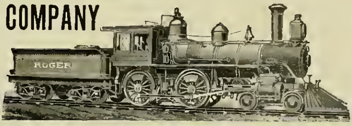

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Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock.

VOL. VII, No. 10. NEW YORK, OCTOBER, 1894. 20 Cts. Monthly $2.00 Per Year.

Mastodon Broad Gauge Locomotives for Brazil.

Our engravings show the class of heavy locomotives that the Brooks Locomotive Works are building for the Brazilian government roads.

The order is for sixty locomotives, fifteen of them being of five foot three inch gauge and the remainder of meter, or $39\frac{3}{8}$-inch gauge.

These great engines are splendid specimens of work, the material being all of the best quality and the workmanship has been subject to especial inspection.

The form is what the Brooks people call the "Improved Belpaire," patented by their mechanical engineer, Mr. John Player—there is not a straight line in it.

The top of wagon top is arched as is the crown sheet about two inches and the crown stays go through the sheets radially.

The firebox is of $\frac{11}{16}$ in. copper, flue-sheets $\frac{15}{16}$ in.

The front, back and the corners of the mud ring are double riveted.

The door hole is formed without a ring, and with both ends of the rivets outside and away from the fire, the back fire sheet being flanged back, and the back head flanged in and then out to make the two edges of sheet come outside the fire door hole.

The boiler, just as you see it, is 28 ft. $7\frac{1}{2}$ in. long and 68 in. diameter. The shallow firebox is 114 in. long and $38\frac{1}{2}$ in. wide inside. The grates are water tubes and pull bars, and the brick arch is supported on tubes from the crown sheet to the flue sheet. There are 248 iron flues $2\frac{1}{4}$ in. in diameter and 13 ft. $10\frac{1}{2}$ in. long. The boiler weighed (without flues or dry pipe) 31,160 pounds, with flues and dry pipe complete, as shown, 46,500 pounds.

The total weight of this engine in working order is 170,000 pounds. Weight on drivers, empty, 138,250 pounds, on truck, 29,000 pounds. Weight of tender, loaded, 82,000 pounds.

The Brazilians admire nice looking things, and require that even freight engines shall have considerable brass and paint. The cylinders, steam chests, sandbox and dome have brass casings, the boiler bands, the edge of the running boards and headlight stand are brass covered; there are brass bands on the stack, and the handrails are of the same material. The cab is finished in natural oak. All the paint of engine and tender is bronze green, relieved by gold leaf stripes.

There are three signal lamps, one on rear of tender, and two on the front of the engine, that are as large as the headlights now used on the New York Central or Pennsylvania roads.

The buffers in front fold back when not in use, and a similar pair are used on the rear of tender.

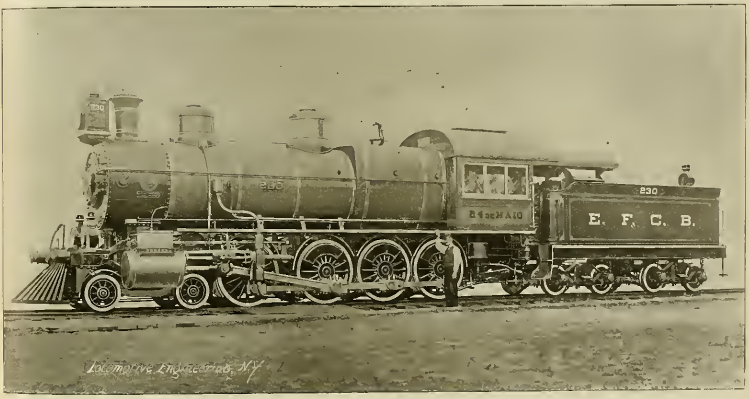
There are three tank valves and three when using steam in the Le Chaletier brake.

Just over the engineer's head is located the whistle lever, and on the shaft running across the top of the cab is the sand lever, there being no other place to locate it that would be so handy or work so easily.

The steam turret is placed in a vertical position on the boiler head as shown; this leaves the top of the boiler head clear of everything and brings all valves within handy reach of the engineer.

The engines have Nathan lubricators, with independent cup for air pump.

The boiler head is lagged and jacketed down to the fire door.



Broad Gauge Mastodon Locomotive for Brazil. Weight, 170,000 Pounds; Cylinders, 21 x 26 Inches.

The general style of the engine can be seen from the engravings. The machine might have been made to look a little better, perhaps, had the headroom been greater, but they are held down to 14 ft. 6 in. by the size of the many tunnels on the line. This caused the cabs to be made with such a rounding roof and the lowering of the running boards so as to get the cab deck down.

The cylinders of these engines are 21 x 26 in. The steam ports are $18\frac{1}{2}$ in. long $1\frac{3}{4}$ in. wide and the exhaust port $3\frac{1}{2}$ in. wide. Richardson balanced valves are used, with $\frac{7}{8}$ in. lap and $\frac{1}{16}$ in. lead.

The driving wheels are 54 in. in diameter with 9 in. axles. The smallest ring in the boiler being 68 in.

This boiler is worthy of especial mention, and is shown very plainly in the excellent engraving. The shell is of $\frac{11}{16}$ in. steel, the seams extra heavy riveted, and the upper stays on the side sheets being spaced very close together.

water hose, one for the pump shown and for the two No. 10 Monitors.

On the meter gauge suburban engines there is a Pintsch gas cylinder and arrangements for lighting signal lamps and headlight with it.

The engines and tenders are equipped with the latest Westinghouse air brake equipment, the American equalized brake being used on the drivers.

The reversing gear is a combination of lever and screw, either can be used.

The arrangement in the cab is plainly shown. The injectors are placed on the boiler head because of the want of room on the side of boiler.

There are four gauge cocks, arranged as shown, and a glass gauge also.

The Le Chaletier water brake is used and has a steam and water valve arranged as shown to the right of the gauge cocks. On the chest covers there are large plug valves operated from the cab, and these are piped to the exhaust pipe of the air-pump; these are used as governing cocks

There is one thing about these cabs that is good, the three windows slide into the space occupied by one and there is no post in the center, the whole side of the big cab is open, and a man can get out very easily and comfortably.

The seat is of the drop pattern, and slides on a rod so as to let the engineer adjust himself to his work.

The tender has a roof over the gangway and front of cab, as shown—these engines carry two firemen.

The engine, truck and tender wheels are cast iron centers with steel tires. All tires are Krupp crucible steel. The apron and running boards are made of diamond rolled steel that seems well adapted to this kind of work.

Taken altogether, they are about the finest appearing and most striking looking locomotives built this year, and if they do not make a record in South America it will be because they are not well handled, and not because they are not well designed and carefully built.

MASTER CAR-BUILDERS' ASSOCIATION.

Subjects and Committees for Convention of 1895.—Secretary John W Cloud announces the following committees for next year's work

1.—*Interchange of Cars.*—To suggest how cars in interchange may be maintained equitably to owners and operators with least expense and detention. Pulaski Leeds, J W. Marden, L. Packard, J. N. Barr, E. H. Nelson, Samuel Irvin, J. H. Rankin

2. *Road Tests of Brake Shoes.*—To conduct and report upon a series of comparative tests of different brake shoes in service, with as complete data as possible—R H Soule, W. S. Morris, S. A Crone, G. W Rhodes, A. E. Mitchell, W. H. Lewis, J. W Marden, A. M. Waitt, Jos Townsend, Sam'l Porcher, J. C. Barber, W. L. Hoffecker

3. *Laboratory Tests of Metal for Brake Shoes.*—To conduct and report upon laboratory tests of different brake shoes, with as complete data as possible—S. P. Bush, D. L. Barnes, J. W. Cloud

4. *Lubrication of Cars.*—Continued from 1894 to pursue its own recommendations as to tests of oil for lubrication, and consider the economies of journal bearings as suggested in its report, if feasible—A. M. Waitt, F. A. Stinard, W. H. Thomas, W. K. Carr, L. E. Wood

5. *Air Brake Tests.*—G. W. Rhodes, S. P. Bush, Geo. Gibbs, A. S. Vogt, E. A. Williams

6. *Air Brake and Hand Brake Apparatus on Cars.*—Continued from 1894, to consider the question raised in its report, and to include the standard levers and all other questions of importance pertaining to the subject—E. D. Bronner, Wm. McWood, Pulaski Leeds, W. P. Siddons, Jas. McGee.

7. *Automatic Couplers.*—To advise what changes may be desirable in the standard size of M. C. B. automatic coupler shanks, and to recommend a standard yoke or pocket strap for rear end attachment to cars—J. M. Wallis, A. E. Mitchell, J. P. Chamberlain, R. D. Wade, Wm. Garstang, T. G. Duncan, Thos. Kearsley.

8. *Mounting New and Secondhand Wheels.*—To report upon the best method for mounting new and secondhand wheels so that they shall be properly located upon the axle—J. N. Barr, G. L. Potter, J. H. McConnell, Wm. Forsyth, T. J. Hatswell, Thos. Sutherland, John Hodge.

9.—*Passenger Car Ends and Platforms.*—To consider what improvements may be made in the construction of passenger car ends and platforms for increased strength in ordinary service and in emergencies—E. W. Grieves, F. D. Adams, Samuel Porcher, C. A. Schroyer, M. M. Martin, T. A. Bissell, J. J. Hennessey.

11.—*Coal Car Sides.*—To suggest best methods of construction and staying of the sides of 60,000-pounds capacity coal cars with high sides—R. E. Marshall, R. McKenna, G. W. West, R. P. C. Sanderson, Samuel Higgins, R. C. Blackall, La Mott Ames.

A correspondent writes that in a recent examination on the air brake the first question asked was, "What is an air pump?" That seemed awful easy but there were as many definitions as there were different men. Just think a moment of what you would say in answer to the same question.

Engineer Thos. R. Berry has run one engine on the New Orleans & Southern R. R. one hundred thousand and seventy miles without having his main rod brasses filed or out of the strap, and they were not pounding when she was taken off the run.

Back Pressure in Compound Engines.

BY HUGH SHARP

When I was serving my time in a locomotive shop in the old country, I remember not being able to get any intelligible explanation of the principle on which a compound engine worked. Back pressure was my difficulty. I could not understand how the high pressure (hereafter h. p.) piston could move when it could not exhaust freely into the atmosphere. Applying to my erector, I was told "That there could be no back pressure, as all connection between the two pistons was cut off." I had sense enough to see that this meant nothing at all, and rightly put him down as being as ignorant as myself on this particular point.

It happened that the erecting shop machinery was run by a curious sort of compound engine. Originally the work was done by a pair of high-speed, non-condensing horizontal engines, but in time it got beyond these, and, by way of getting increased power, an old-fashioned beam engine and condenser was added to the plant. The beam engine, however, did not get live steam from the boiler but had to make out with the exhaust from the horizontal engines. The old man running this badly matched team ought, I thought, to be able to give me a pointer in compounds, and I put the same question to him with regard to back pressure that I had previously put to the erector.

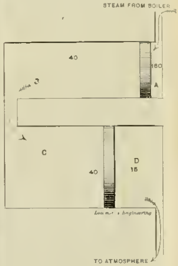
"It's the condenser as does it, sonny," answered the veteran, cheerfully, "the condenser just draws the steam out'n her. Come over here, and you can hear the air pump a-sucking!"

"But a compound locomotive hasn't got a condenser," I objected.

"Compound locomotive. Never heard tell of a compound locomotive (this was in 1879), but if it ain't got a condenser 'taint worth a damn!"

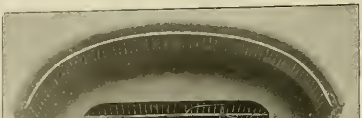
Eventually I thought the matter out for myself, and never having seen any textbook on the steam engine which refers to back pressure on the h. p. piston, and at the same time believing that this proves a stumbling-block to other beginners besides myself, I think the following may be of some service to them. I have made no reference to the action of the valves in controlling admission and exhaust as such reference is not necessary and not relevant, and for the same reasons I have not considered the effect of the receiver, points of cut off, etc.

An outline section is given of a high and low-pressure cylinder with pistons. Steam at 160 lbs to the square inch is admitted to *A*, the "live" side of the h. p. piston. Suppose, for a moment, the exhaust from *B* had been suppressed. Obviously the h. p. piston would be unable to make a complete stroke, as the back-pressure would quickly equal that of the boiler steam, causing the piston to be in equilibrium. But let the exhaust between *B* and *C* be opened. The effect will be that the confined steam in *B* will have approximately four times as much room to expand in—

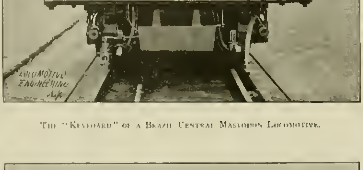


supposing the ratio of 3 to 1 exists between the two cylinders, which represents the usual practice—and with a four-fold volume there will be a four-fold reduction in pressure; so that the back pressure will fall from 160 lbs. to 40 lbs to the square inch. In other words, the effective pressure—the pressure available for moving the piston—will be 120 lbs. to the square inch. We need not consider the h. p. cylinder further.

Turning to the l. p. cylinder, it will be seen that the exhaust it has just received from the h. p. cylinder is 40 lbs to the square inch. This is not effective pressure as the back pressure on the exhaust side is 15 lbs to the square inch. This latter is not steam pressure, for it will be noted that the exhaust is represented as open to the atmosphere, it represents the normal atmospheric pressure, which always has to be reckoned with in non-condensing engines, for it is evident that if expansion is carried too far, or if the boiler pressure is too low, the atmospheric pressure on the exhaust side of the l. p. piston may exceed the steam pressure, and that piston, so far from doing any work, will act as a brake. The same undesirable result may, of course, be brought about by throttling. The dragging of a piston from one or other of these causes is more likely to occur in a compound than in a simple engine, but it may occur in the latter also.



THE "KEYBOARD" OF A BRAZIL CENTRAL MASTODON LOCOMOTIVE.



BOILER FOR MASTODON LOCOMOTIVE, FOR BRAZIL CENTRAL.

Secretary Jno. W. Cloud, of the M. C. B. Association, has sent out their twenty-eighth annual report, and a good one it is. The details of all ballots are published, as well as all the decisions of the year by the Arbitration Committee. New lithographic plates of all the Master Car Builders' standards are inset into the back of the book. The papers submitted at the last convention of the association were particularly interesting, and contained many illustrations, all of which appear in the reports.

New Class "P," With 80-inch Drivers for the P. R. R.

Our illustrations on this page will convey some idea of the new class "P" engines recently turned out of the Juniata shops of the P. R. R. for the fast express service of that road.

The principal difference between this engine and its predecessors is the employment of a driving wheel 80 inches in diameter.

However, the details of the engine have been gone over most thoroughly and every part improved where the service seemed to call for improvement.

The stack is one casting, of very small size. A single nozzle with 4½-in. tip is used.

The handholds and steps are first-class.

The cab has a ventilator, but is rather hot and crowded. The reverse lever is very short and not too easily handled, and the throttle rig is one of those grapevine affairs that climb around the boiler and crawl into a hole in the end.

The Belpaire boiler is not far different, except that the corners are not so square, the mud ring is double riveted, and hand-holes and plates are used on the water leg in place of wash-out plugs.

New Class "P" Express Locomotive, with 80-inch Drivers, for Pennsylvania R. R.

This series of engines is the first in America that we know of that have what may be called a first class ash pan. The pans are made of cast iron and the dampers close air tight.

The form of guide is the four bar variety, except that for the two top bars are substituted a cast iron one, 10 inches wide, with a large strengthening rib in the center. The lower guides are of steel, as is also the crosshead. This has been improved in making it lighter and in the method of holding the piston rod, a nut being used and the troublesome key discarded altogether.

The tires are 4 inches thick. The link motion has been redesigned throughout, the principal improvement being in the links themselves, these are 3 inches wide and have ample oil cups forged on them, the link hangers also have cups forged on them, and the rods, eccentrics and straps are exceptionally heavy.

The rocker shaft is some 6 inches longer than usual, and has two bearings in the box with a collar on center of shaft between them.

The travel of the valves is 6 inches, lap 1⅛ inches.

All rods are of I section, all cups forged on.

The pistons are made of one thin plate of steel carrying a wide cast-iron shoe or ring, that in turn carries the packing rings proper. These are only half an inch wide, and are sprung in with an improved lap joint.

The cylinder cock rig operates a third cock, that is tapped into the steam passage to the cylinder to prevent water from going over. This is a first-class rig, worth more in dollars per trip than it costs cents in the first place.

The front trucks have air brakes, the equalized pull brake being used on the drivers.

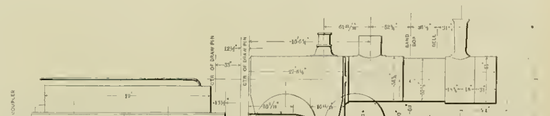
The headlight bracket is something new, neat, unique and sensible.

The sand box has been put on top of the boiler, instead of in the wheel covers.

The tender is fitted with a scoop of a new pattern.

In addition to the dimensions given on the detail drawing, the following particulars will be of interest

Capacity of tender—water, 3,000 gals.
" " coal, 15,000 lbs.
Weight of " empty, 30 100 lbs.
" " loaded, 70,000 lbs.
Spread of cylinders, 6 ft. 5 in.
Distance between center of frame, 44 in.
Width of cab roof, 9 ft. 8 in.
Width of cab, 9 ft. 7 in.
Height of cab roof from rail, 13 ft 5 in.



Inside length of firebox, 9 ft. 11¾ in.
" width " 40 in.
Number of tubes, 258.
Length of tubes between sheets, 136 in.
Outside diameter of tubes, 1⅞ in.
Weight of engine—empty, 114,500 lbs.
" " on drivers, 79,500 "
" " on truck, 35,000 "
" in working order, 125,800 "
Weight of engine on first drivers, 42,400 lbs.
Weight of engine on second drivers, 44,500 lbs.
Weight of engine on truck, 38,900 lbs.
Total weight of engine, 125,800 lbs.

Train Brakes in Europe.

[EDITORIAL CORRESPONDENCE.]

There are several kinds of train brakes in use on the Continent of Europe, but the Westinghouse is by far the most popular. In talking with officials in charge of brakes, I found that while slow to pass an opinion upon the merits of other brakes, they were never slow to praise the Westinghouse, the conspicuous merit being that it was always ready for doing its work when wanted. The implication conveyed was that the others were much less reliable.

An official of one of the French railways was quite enthusiastic about the service the Westinghouse brake had performed just a few days before in preventing a disastrous accident. While one of their crowded express trains was running at a speed of about forty-five miles an hour, a tire of one of the carriage wheels broke, and a piece in flying off broke the air-brake pipe. The car went off the rails, but the brakes did their work so well on the other cars that the train was stopped in a remarkably snort space and before any serious damage was done.

When one familiar with American railway train service begins to ride in European trains he is almost certain to be struck with the amount of wheel sliding that goes on in the stoppage of trains. The cars are nearly all very light and comparatively little damage results from wheel sliding, but still there is nothing more common than the peculiar bump of flat wheels. In fact, flat wheels made several of my journeys decidedly uncomfortable. My attention was directed to the prevalence of wheel sliding on the first trip I made in France after landing, and I did not travel on a single railway during the whole of my rambles where there was not evidence of wheel sliding such as would not be tolerated on any road in America. I stood for two hours at a crowded junction point in Scotland and watched the wheels of numerous trains as they stopped. I did not find a single train that stopped without wheel sliding.

I spoke to the officials of several railways about the prevalence of wheel sliding, and they all attributed it to the carelessness of the enginemen. My own opinion is that it is due to high air pressure and too great leverage. Wheel sliding is just as common with vacuum brakes as it is with air brakes.

In going through railway repair shops one is struck with the number of wheel lathes to be seen at work. I am persuaded that the prevalence of wheel sliding is responsible for a great deal of the work that has to be done.

On all European railways that use the air brake there are rules demanding the testing of the brakes when the engine is coupled on or when the train has been broken to take on or put off a car. This rule is regularly adhered to when engines are changed, but I noticed several times when cars were put off that they did not stop to test the brakes. There is great pressure put upon the men to get the trains through on time, and they take chances to save a few minutes.

Very little progress has been made in Europe in applying air brakes to freight cars, but some of the leading railway authorities believe that all cars carrying merchandise will eventually be equipped with continuous brakes. A. S.

The Senior Philosopher is home again from a foreign shore, the J. P. will now "visit 'round."

How Rails, Cross-Sleepers and Ballast Usually Behave to Each Other.

BY JOSEPH ANTHONY

Both by observation and by accurate measurements, the superstructure of a railroad, while trains are passing over it, may be shown to undergo a constant series of vertical movements, and thus there is furnished no real and due rail plane for the moving loads.

The accompanying figures are drawn to illustrate track conditions as they ordinarily prevail in the common cross-sleepers system of rail supports.

When a railroad track is newly built the usual relation to each other of the rails, the sleepers and the ballast, is represented by Fig. 1. Everything in this combination is, apparently as it should be.

Place the load on the rails that the structure is built to carry, and Fig. 2 represents the changed relations of the several parts. In a vertical direction the ballast has proved to be partially unstable, and, the sleepers being in a measure flexible and having a less area of bearing on the ballast which is outside of the rails than it has on that inside of them, has bent, and thus accommodated itself to the condition. Whatever is true of one sleeper is largely so of them all, and with like materials and so arranged, a tendency to no other result than that of bending under passing loads and a consequent compression or displacement of the ballast can be expected.

When the load has been moved off of that portion of the rails which is immediately over the sleeper, all the parts, except the ballast, tend to regain their normal relations. In this last there is no elasticity, and Fig. 3 shows what that relation in practice largely is.

If the sleeper was positively stiff, the pockets here shown to be under its ends, could not obtain. While a ballast that was at one yielding, might allow a rigid sleeper to settle, it would stay settled; it would have no tendency, of itself, to regain its first level, and there could not, under the numberless changes from loads to no loads, be that displacement of ballast, as either dust or of mud, that the present pockets show, and in actual use, prove to be so well fitted for.

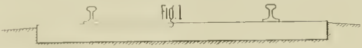
These last named three figures show the successive changes that take place in a track in daily use when it is viewed in cross section through one of its sleepers. A further view is to be had by showing a longitudinal section at the sleepers' ends, as by Fig. 4. Each sleeper of the seven in the figure is here shown to be unloaded, after use, like the one in Fig. 3, and needs no further explanation. If Fig. 3 shows the truth so must Fig. 4. Fig. 5 is next in order, and for convenience of reference, this cut shows the track loaded, the sleepers numbered, and the load to be on the middle sleeper in it and which is numbered 4.

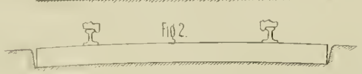
A rail, as here shown, is no less rigid vertically than is a sleeper; a load on the first affects it as it does the sleeper beneath, and over whatever sleeper the load may happen to be (No. 4 in this cut) that one will be most bent, and, as shown by Fig. 2, will be likely to rest on the ballast quite along the whole of its length. As a consequence of this, there is no cavity under it, while slight ones exist and are shown under 3 and 5 on each side of it. Under sleepers next farther away, 2 and 6, the cavities are of greater vertical extent, until at a distance yet more removed from the loaded rail's influence, as at 1 and 7, they reach to near or quite their extreme height. Thus the weight from any source—say a pair of drivers—while on the rails over any sleeper, as the one 4, rests on a diamond-shaped area of ballast like that embraced by the shaded portions of the sleepers 1 and 7 in the next figure. These shaded portions represent the several bearings of all the sleepers while the load is over the one marked 4. This Fig. 6, in plan, is of such a length as to embrace the seven sleepers in Figs. 4 and 5, and shows by its shaded portions that the loads which are borne are as really floated as are the loads which may pass over a pontoon bridge. No one sleeper, as the foregoing figures show, is of sufficient base area on the ballast to remain absolutely intact in a vertical direction; the ballast under each yields in a degree, and relief to the sinking sleeper comes through the rail's agency, from its neighbors on each side of it. Sleeper 4, the loaded one in this, as in Fig. 5, presents the whole of its bearing surface on the ballast, say equal in extent to 5 square feet; sleepers 3 and 5 jointly, furnish say 7 feet bearing; sleepers 2 and 6, say 6 feet, and sleepers 1 and 7 about 5 feet more, making in all some 23 square feet of bearing which is required to float the load.

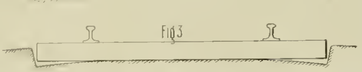
These figures are in nowise given as exact measurements, but rather in connection with the cuts, to illustrate the principle which is involved in the support of a track when it is made of materials that are yielding in their nature.

Thus, by the combined aid of a number of sleepers only, are the rails kept above ground. What one sleeper lacks in floating power is supplied by its adjoining ones until the sum total suffices for the need. This, too, is true along all portions of the track, for the condition accompanies and is ever under the moving load.

A ballast which is unyielding in the least degree, as would be a solid masonry foundation, being out of our reach, even if such were desirable, the question then is, may there not be, within reasonable cost, a rail support devised having within itself alone a sufficient base area to float the load on the ballast without, by the rails bending, seeking so largely its neighbor's aid? This done, the dust raising, the mud throwing, the sinking joints, the ever maladjustment of the rail's plane, and the danger and large cost involved in a plant which is maintained under such conditions of instability, may no longer obtain. Both for economy of operation and for easy riding it is needed that the rolling plant of a railroad should run under the same conditions of stability and smoothness as does a stationary plant of like extent and value. For this, its substructure, as it approximates to a oneness of plane under loads, instead of many of them, will be effective, and a large waste in its maintenance will be stopped, and in that of the rolling plant as well.







The Long Distance Fast Run Record Broken.

The Plant system of railroads and the Atlantic Coast Line, the Richmond, Fredericksburg & Potomac and the P. R. R., seven different lines in all, have taken an excursion train from Jacksonville, Fla., to Washington, D. C., a distance of 780.9 miles, in 15 hours and 49 minutes.

In this distance there were thirty-four stops made in all, consuming 71 minutes of time. The average time, including all stops, was 49.37 miles per hour, excluding stops, 53.36 miles per hour.

They changed engines seven times, the longest change requiring 10 minutes, the shortest only 4 minutes. The fastest time by any one of the roads was over the N. E. Ry. (a part of the Atlantic Coast Line), they ran over the division of 95.7 miles in 99 minutes. The fastest mile was made by the S., F. & W., time 48 seconds, or 75 miles per hour.

All the engines used had 18 x 24-inch cylinders, all were American 8-wheelers, except one mogul, on the R., F. & P.

The S., F. & W. engine had a six-foot wheel and was in charge of Engineer M. W. Cahill.

The C. & S. engine had the same sized wheel, Engineer L. M. Raymond in charge.

N. E. Division, A. C. L.—Engine had a 5-foot 6 inch wheel; engineer, William Corrie.

Wil. Division, A. C. L.—Engine had a 5-foot wheel; engineer, Jack Bissel.

Rich. Division, A. C. L.—Engine had a 5 foot 4½-inch wheel; engineer, Jas. O'Brien.

R. F. & P.—Engine had a 5-foot wheel, engineer, H. Perdue.

The P. R. R. engine also had a 5-foot wheel and was run by R. B. Donald.

Such a string of roads and engines of such dimensions are not expected to make long fast runs; there are usually too many "hitches." But these roads and these men have proven what they could do if given a show.

Jacksonville is 1,020.9 miles from New York, yet some of the passengers on this train, after stopping in Washington 36 minutes boarded a regular P. R. R. train and arrived in New York City 22 hours and 10 minutes from Jacksonville. The engine and train, empty, before leaving Jacksonville, weighed 242,300 pounds.

Two Hundred Miles per Hour!

From Orange City, Florida, comes a glowing account of the Lewis engine, which is to make the run from New York to Chicago in five hours. The report says a full description is very properly withheld—yes, indeed. But it is a rotary, transmits its steam into electricity, condenses its own steam into water again (by use of a wind wheel), and yet the report adds:

"This anomalous machine is divested of all superfluous and disagreeable concomitants. It will have no fire, no smoke, no cinders, no sparks, no tender or stoker. It will have no piston-rod, no dead center, no crank, no cylinder, no cam rods or cut-off. Thus minimizing friction.

"The driving wheels are to be 10 feet in diameter, covering 30 lineal feet of rail at each revolution. But its comparative superiority will be more readily comprehended by the statement that it has a leverage of 240 inches, while the best engines now in use have but 46 inches."

Oh, dear! oh, dear! Suppose the engineer gets dizzy—or, horrors! some one should build another with a leverage of 241 inches and beat it.

The inventor says it will only be in a jog-trot at 60 miles per hour, and that it will run continuously as long as there are rails for it to run on, without having to stop for water, etc.

It will be the ruin of the budding business of compounding, too, for it's going to save 80 per cent. of the fuel. May be if the inventor would put another condensing "wind-wheel" on the front it would save a 100 per cent., and that would ruin the coal business.

It's no wonder people hide their money now; one never knows when one makes a safe investment—with all these revolutionizing inventions.

The Heroes of the Great Fire.

We are glad to present herewith the pictures of the four heroes of the St. Paul & Duluth train that saved some 300 lives at Hinckley, Minn., during the great forest fire.

In fire and wreck at sea, the captain is the man who, as a rule, gets the most praise, and Engineer Root will have his praises sung for a generation as the hero of Hinckley—and he deserves it—but we want the reading public to recognize *all* the heroes of that awful day, for surely if Fireman John McGowan had not been made of the right kind of stuff, with cool nerves, iron constitution, and a will to "do and dare," Root and his train load of human beings would have perished.

Conductor Sullivan did his duty in his place—and no hero can do more.

Porter Blair was no coward when it came to the trial by fire, and did manfully what he was put in his place for—protected the ladies in his car.

The horror of Hinckley will never be forgotten by those who saw it nor by the people who read of its disasters. Those who stop to think will be glad they live among men capable of such heroic self-sacrifice as the crew of this train exhibited in saving the lives of the people on their train. They were selected at random from 30,000 train crews in service in this country, and were not found wanting. Perhaps we can best tell the story of Hinckley by copying from a personal letter from Mr. George D. Brooke, master mechanic of the St. P. & D., in charge of the men at Hinckley.

"The condensed facts of this event are as follows:

"Engineer Root left Duluth on the afternoon of September 1st, on our limited train for St. Paul. Train consisted of combination car, one coach and two chair cars, Engine No. [illegible], Fireman John McGowan, and Conductor Thos. Sullivan. During the previous two weeks the smoke from forest fires was so thick in the vicinity of Hinckley that the front of the engine could not be seen from the cab in the day time, and it was frequently necessary to run with the headlight lit in broad daylight.

"The conditions on this day were not different from what they had been contending with for a number of trips until they began to approach Hinckley, when the smoke became denser and more oppressive. They kept on, however, expecting to get through it shortly after leaving Hinckley. When within three-quarters of a mile of the station they ran amongst a lot of fleeing people, signaling them to stop, which they did. The engineer and conductor then found out that Hinckley was all on fire and the track impassable, and that our bridge right at the town was on fire.

"There was an extra freight train running behind them, but the conductor and engineer decided that it would be safe for them to back up as far as Skunk Lake, six miles back, which owing to the total absence of rain for the last three months had evaporated down to a mere mud hole and morass. After loading up all the refugees in sight, and waiting until the cars began to catch fire, they started back. Although they ran the six miles in about eight minutes, the hurricane of flame overtook them. Almost at the start the heat bursted cab windows, pieces of glass cutting Engineer Root severely in the neck near jugular vein and in the head. The cab was on fire with flames shooting in at the windows, which, with the loss of blood, soon weakened Root so that he fell over on deck, while the fireman had gone to drop himself in manhole of tank in order to thoroughly wet his clothes, after which he came back with a bucket of water and throwing it on Engineer Root revived him and assisted him to his place again. About this time the cab curtain strings burned off letting curtain down, which immediately took fire, but was torn off by the fireman. Fireman McGowan then commenced drawing water from tank, throwing it continuously over the engineer, himself and a refugee who had crawled on the engine just as they started back, and and who lay overcome in the gangway.

"With the reviving action of the water, Engineer Root managed to retain his seat, while the fireman fed the firebox and operated the injector. After reaching the trestle at Skunk Lake the engineer stopped his train, which in the meantime was all on fire, with windows all out on one side, and the train crew unloaded the passengers and got them down in the lake. All that remained in the lake were saved. Some of the refugees, however, jumped off before the stop was made, owing to the heat and flames, and were burned.

"In the meantime the fireman helped Root down from the engine to the lake, and then went back to try and get the engine away from the burning train and off the trestle. He endeavored to put out the fire on tender, but as the coal was on fire he had to give it up. He then filled the engine with water, put in a good fire, and cutting her loose from tender, ran her ahead. He then went down in the lake and spent the rest of the time caring for his engineer and others until the relief train reached them from Duluth.

"This limited train had between 125 and 140 regular passengers, and they picked up at least 200 refugees, if not more; the exact number can never be determined. The conductor, Thos. Sullivan, as soon as his passengers were unloaded, started back to protect his train and send notification of the disaster. After reaching Miller station and sending his message, human nature could stand no more, and he had to succumb to the strain.

"Our brakeman, colored porter and news agent proved themselves the right men in the right place. The porter using the fire extinguishers putting out the flames as they broke out in the dresses of his lady passengers.

"Of the heroism of Engineer Root too much cannot be said, and a close second comes his brave fireman, John McGowan, whose physical ability not only sustained himself but assisted Engineer Root to stick to his post. To give you a faint idea of the condition of affairs in that cab, the lagging caught fire and notwithstanding the rapidity with which they backed up the flames were swifter and blew back in cab, setting front of cab on fire, burning all the wooden handles of steam connections, and melting cab lamp. Running boards were alse burned as well as cab seats charred.

"Engineer Root is the ranking engineer on this road, having run here since May, 1871, and is a whole-souled specimen of generous manhood, and knows no fear when working in the interest of others. He will be recollected by the B. of L. E. delegates throughout the country as one of the Executive Committee at their recent convention in this city.

JAMES ROOT, ENGINEER.

J. E. McGOWAN, FIREMAN.

THOMAS SULLIVAN, CONDUCTOR.

J. W. BLAIR, PORTER.

"The officials of this company are proud to say that all their trainmen proved themselves heroes in the truest signification of the word, in this, the greatest emergency they have been called upon to pass through. All of them are doing well and are around, Engineer Root, however, being extremely weak on account of the great amount of blood lost.

"As another instance connected with this fire, Engineer C. P. Fadden and Fireman N. Reider were bringing crippled Engine 19 on one side, light, from Duluth to St. Paul and had reached Hinckley before the fire. Dispatcher was just sending him orders for continuance when the fire reached the wires south of Hinckley and they went down. This tied him up at Hinckley with his engine, and when the flames struck the town, without going through the formality of asking permission, he ran his engine over on the Eastern Minnesota tracks and backed down near their roundhouse, which was protected slightly by an open patch and a grove of green trees and was the only building left standing in the town. Engine was slightly scorched and lagging burned, but crew stayed with her and brought her out in good shape.

"Engineer Fadden is next to Root in standing rights, having been on the road since 1872, and when asked for a description of the conflagration at its height, flames and smoke being all around and over him, replied that 'he had been in hell, and saw everything there was to be seen, except Satan himself.'"

Everyone loves a hero, and our railroads are manned by many of them, but few have had the chance to show what was in them as these men have, but when it comes to a trial most of them are there. The trouble with most railroad heroes is that they are killed in their acts of heroism.

All honor to Root, and McGowan, and Sullivan, and Blair. Their acts were ten times as heroic as a charge in battle—and two hundred people owe them their lives.

Some Automatic Valve Closing Devices

The accompanying illustrations show the details of several cab fittings recently patented by Mr G. W. Akerlind, one of the winners in the prize contest for such improvements offered by this paper. Mr. Akerlind has tried to cover every point of danger on the boiler. The engravings were made direct from his drawings and we quote from his own description

The accident automatic valve arrangement as shown on accompanying drawings, is intended to automatically prevent steam from leaving the boiler through broken pipes and valves, etc., in case of collision, front or rear, or other accident to the locomotive, the most serious damage to life and limb often being caused by steam from broken parts of the engine.

The receiver or fountain 1, shown in Fig. 1, contains the steam outlets for injectors, air pump, blower pipe, steam heating, lubricator, etc., and also the momentum weight 2, the links 3 and 4, the stem 5 and the lifting arrangement 6.

The fountain is connected to the boiler 7, and the ball joint 8 with the studs 9.

The ball joint 8 connects to the valve house 10, which contains the valve 11, carried on the spring 12 and guided by the cover or cap 13, and the bridge 14 in ball joint 8. The steam pipe 15 leads the steam from dome of boiler

The arrangement will work in the following manner

In the position of the arrangement, as shown by full lines on drawing No 1, the momentum weight 2, the links 3 and 4, and stem 5 are screwed down by the arrangement 6, and compresses the spring 12, leaving free admission for the steam into the fountain 1, from where it is distributed wherever it is wanted.

The pressure of the spring 12 is carried on the safety rivets 16 of sufficient strength for the pressure, but in case of collision, front or rear, the momentum of the weight 2 will break said safety rivets 16 and thereby disengage the links 3 and 4, when the spring 12 will lift the momentum weight 2, and force the valve 11 against the edge 17 of the valve house 10, and thereby shutting off the steam from the fountain 1.

The valve 11 contains a ring of soft metal or gasket, in which the edge 17 will be forced by the spring 12 and the steam pressure and form a steam-tight joint.

Should the collision not disable the engine, the valve 11 can be opened by screwing down the arrangement 6 until the end of the link 4 bears on the stem 5, the slot 18 passing over the pin 19 in the momentum weight 2

By taking off the lid 20, the momentum weight can be taken out and new safety rivets 16 put in

The dotted lines on drawing shows position of the momentum weight 2, links 3 and 4, stem 5 and valve 11 the moment after collision, when the momentum of the weight breaks the safety rivets 16 and describes an arc, with the pin 21 for center, striking the end of fountain 1 or the lug 22, as the case may be.

Center of gravity of momentum weight to be below center of support to insure proper position of weight, the motion sideways being limited by the lugs 22.

Should an accident break off the whole fountain 1, the stem 5 will leave bridge 14 in ball joint 8, or else break the point 24, and thereby release the valve 11, which will then be closed against the edge 17 by the spring 12 shutting off the steam

The ball joint 8, of ample strength, and connected to the valve house inside the boiler in such manner as to insure the greatest possible safety.

For repair work the valve 11 may be closed by raising the momentum weight 2 and the stem 5 by the handle 25.

In Fig. 2 the fountain 1 contains the steam outlets for injectors, air pump, blower pipe, steam heat, lubricator, etc., and also the momentum weight 2 the links 3 and 4, the stem 5 and the lifting arrangement 6, and also the additional links 3A and 4A.

The fountain is connected to the dome of boiler by the steam pipe, in which the stem 5 is inclosed.

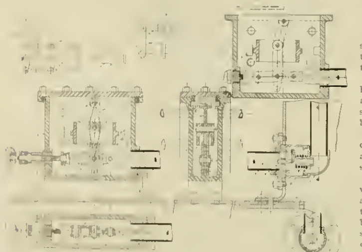


Fig. 2.

Fastened to the dome is the valve house 8, containing the valve 9 supported on the spring 10 and guided by the elbow 11, which takes a pipe to convey dry steam from top of dome.

The arrangement will work in the following manner

In the position of the arrangement, as shown in full lines on drawing No. 2, the valve 9 is kept open by the stem 5 and the screw arrangment 6.

The force of the spring 10 is carried by the safety rivets 12 of sufficient strength for this purpose, but will be broken by the force of the momentum weight in case of front or rear collision.

Dotted lines show position of the arrangement the moment after collision, front or rear, the safety rivets 12 being broken and the stem 5 and link 3 forced back by the spring 10, and the valve 9 forced against the edge 13, and thereby the steam shut off from the steam pipe 7 and the fountain 1.

Should the engine not be disabled by the collision, the valve 9 may again be opened by the screw arrangement 6, the rib of stem 5 being guided by the steam pipe.

The lugs 14 and 15 will limit the movement of the momentum weight which is hung on the link 4A, and will describe an arc with the pin 16 for center.

By the handle 17 the valve 9 may be closed or opened at will.

Should the whole fountain be broken off, the stem 5 will leave the bridge 17 or else break at the point 18, thereby releasing the valve 9, which will then be forced against the edge 13 by the spring 10 and the steam pressure.

The steam pipe 7 being slightly grooved at the point 19 to facilitate the breaking at that point.

In Fig 3, the steam whistle is fastened to dome of boiler with the connection 1

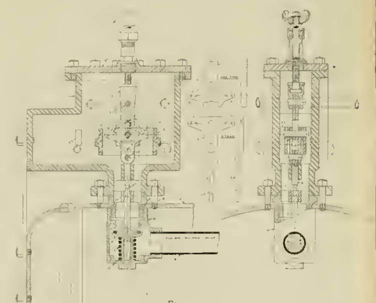


Fig. 1.

screwed into the valve house 2, which in turn is screwed into the flange 3, riveted to the dome.

The valve house 2 has openings *A* to let in steam, and the nut or cap 4 supports and guides the valve 5, forced against the spring 6 by the stem 7 fastened to the bridge in the connection 1.

The steam whistle is screwed into the elbow 8 containing the valve 9, forced against its seat by the spring 10 and the steam pressure and opened by the lever 11.

If the steam whistle and the elbow 8 with the valve 9 is broken off, the breakage will take place at the point 12, and thereby releasing the valve 5, which will be forced against the edge 13 by the spring 6 and the steam pressure, shutting off the steam

The safety valve is attached to the connection 1, which is screwed into the valve house 2, which in turn is screwed into the lid 3, covering the dome.

If the safety valve is broken off, the

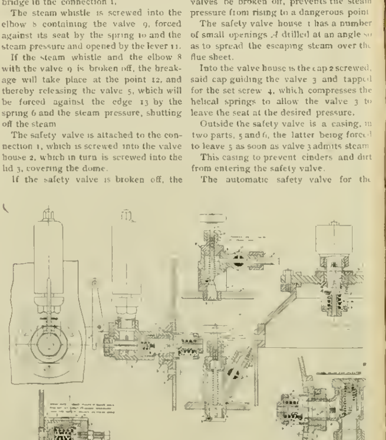


Fig. 3.

breakage will take place at the point 4, thereby releasing 5, which will then be forced against the edge 7 by the spring 6, the arrangement being practically the same as for steam whistle.

The injector check valve 1 is screwed into the valve house 2, which in turn is screwed into the flange 3 riveted to the boiler.

The valve 4 is guided by the nut or cap 5, and kept in position by the stem fastened to the bridge 7.

If the check valve 1 is broken off the breakage will take place at the point 8, thereby releasing the valve 4, which will then be forced against the edge 9 by the spring 10 and the steam pressure.

The safety valve shown is intended to be placed in the smoke arch or other protected place; said valve set to open at a higher pressure than the ordinary safety valves on dome of boiler, and should these valves be broken off, prevents the steam pressure from rising to a dangerous point

The safety valve house 1 has a number of small openings *A* drilled at an angle so as to spread the escaping steam over the flue sheet.

Into the valve house is the cap 2 screwed, said cap guiding the valve 3 and tapped for the set screw 4, which compresses the helical springs to allow the valve 3 to leave the seat at the desired pressure.

Outside the safety valve is a casing, in two parts, 5 and 6, the latter being forced to leave 5 as soon as valve 3 admits steam

This casing to prevent cinders and dirt from entering the safety valve.

The automatic safety valve for the steam gauge consists of a main body 1, inclosing the valve 2 and a three-way cock 3, cap 4 with packing nut 5 and coupling 6 and 7, and also screw 8 and handle 9.

This safety valve will work in the following manner

In the position of valve 2 and cock 3

shown on drawing, the steam will enter at 10 and pass the narrow circular opening at 11 and the outlet 12.

By the speed of the current of steam the valve 2 will be lifted and strike the edge 13, and by the force of the pressure will remain in that position, shutting off the steam

If the cock 3 is turned half a revolution, the screw 8 pressing down the valve 2, the steam will enter the pipe leading to the steam gauge. When the steam pressure is equal on both sides of the valve 2, the screw 8 may be raised, valve 2 remaining open until the pipe is broken.

Should the whole valve house be broken off the breakage will take place at points 14 and 15, thereby leaving the end screwed into the boiler, together with the valve 2, which will close at the breakage and be kept in position by the pressure of the steam and thereby prevent steam from leaving the boiler.

Economy in Use of Oil.

BY C. B. CONGER.

Doc tells me that they are having a great time on his road trying to get bigger mileage out of a pint of oil. They used to have all the oil they wanted to use, "when they oiled around, to make a sure thing, they gave her a good oiling, so she would not run hot."

But the M. M. issued a circular telling them that less oil and more care in looking after the engines was needed to do away with delays and expenses of hot boxes. Only a few of them paid much attention to it at first. They thought it was a bluff. We will let him tell about it in his own way.

Doc says he was sitting up on his engine the other day talking with Brown, his old fireman, who was promoted about five or six months ago. Brown says to me, "Father Troy" (he 'tended a wedding at my house a while ago, he wasn't a spectator neither—likely it will be grandfather Troy in a year or two), "how did you come to brace up and be saving in oil You know you used to pour as much on the ground every time you oiled around as you use altogether now, trying to do better in your old age, are you?" Just about that time young Bonaparte, who had been set up about three months, and feels pretty gay, got up on the engine and says to me, "Old man, where do you steal your oil now?" Says I, "If I thought you knew enough to tell whether you meant that, I would cuff your ears for that remark. Don't have to steal any oil; we can get all we want out of the storeroom" Says he, "You know darned well that there ain't any man can run on as little oil as they say you are doing now. Three months ago you used as much oil as anybody Now you don't show up half as much. How is it?" Says I, "That's so, and next month I won't use as much as I do now Catching onto how to do it—see, my fresh young friend? You fellows will have to come to it before long too."

After the M M. got out his circular about making better mileage on oil, Ike came to me and says, "Doc, you know if you just half try, you can cut down your oil bill to just half. If there is anything wrong with your engine that runs hot or uses more oil than you think it should, let us know about it and we will get it fixed. If the pins run hot because the brasses do not fit, or any of the journals are cut or have poor brasses on them, they ought to be made right. Don't depend on valve oil, and lots of it, to make a bad bearing run cool. Report it on the book, telling what is the matter with it."

Well, I tried hard. Those rules, Clinton, that you gave me for saving oil were a big help, and the first month I made a big increase in miles to a pint of valve oil, because it wasn't poured on all the warm bearings and used in rod cups; had to get all the feeders changed, though, they fed machine oil out too fast.

About a month after that, Ike came around again and says, "You are doing very well, but you ain't quite up to the mark yet. Get a move on you, old man, or some of the young fellows will beat your record" That made me hot to have him throwing what the young runners could do up into my face. Says I, "See here, Ike, if you get the men running against each other to see who can run the cheapest, you will have the worst lot of cut pins and hot axles you ever saw, besides having hard feelings among the men; because some extra man takes an engine and runs her a week on next to nothing, which a regular man can't do." Says he, "If a man don t use oil enough and has something hot, it takes more oil to get it cool, besides losing time with his train. He won t make that mistake more than once without hearing from it As to hard feelings, never mind that; in this oil business the best man will get to the front. If you have any hard feelings against any man because he is making a better record than you are with the same chance, you had better try a little harder yourself on your own engine, you have too much sense to do anything else." Says I, "When we get to making pretty good mileage, what will satisfy you; will you want us to get down finer every month, or how will you set a standard?" Says he, "The fellows that are at the foot of the list will catch it every month, till you are all about up to the average. The standard ain't what the poorest fellow feels like making, but it has got to be as good as the average." "Yes," says I, "but how about the fellows stealing oil, some of them will steal enough, so they won't need to draw very much?" Says he, "Just name some one who steals oil, we will put a stop to that mighty quick, most of this stealing oil is in your mind's eye. If you know a man is getting oil where it is not charged to him, say so, we will hunt him up, but the trouble is you can talk about stealing oil and don't mention names."

Well, I see it was no use to talk with him; he is awful set in his notions, so I buckled down to it and the next month made about as good a record as any of them, but you can just bet your bottom dollar when this thing blows over, and they get onto some new plan of running cheap, I ain't going to wear myself out jumping down to look her over every few miles and putting on about three drops of oil at a time. I am going to pour on enough to make a sure thing, and not worry if some of it does run on the ground. It is too much work to run so fine on oil.

The other fellows are kicking worse than I am about it. When we first started in we all agreed to make a little improvement each month and try to make that do; but a lot of them got right down to business and made such big mileage, they got after the others; so we had to commence to scratch around, each fellow for himself Ike don't say much, but you can bet he is at the bottom of the whole thing Four of the engineers were called in the old man's office on the carpet the other day, and he talked to them like a "Dutch uncle;" said the idea was not to save a little oil half so much as to make them look after the bearings closer, and know what shape they were in. He showed just what it cost to do the running repairs for each man for the last six months, and the fellows that made the biggest kick on oil cost the company the most for coal, repairs and oil. That staggered them, but they came out pretty sober, and went to the shop to do their kicking.

Doc kicks, not so much on the risk of hot boxes and expense for machinist work, as because it is a new departure for him to try to save oil. He daresn't put on too much for he gets "jacked up" for wasting oil, if a bearing gets cut or runs hot he gets "jacked up" for damage to engine and laying out the train, so he is between two fires. But, just the same, it is more a test of skill to run cheap on oil than the economy on the oil sheet shows. Close on oil means close inspection of your engine, both before and on the run, close figuring for speed and amount of oil required for it, seeing that bearings are in good shape so it does not take a quart of valve oil to cover up a machinist's mistake in reducing brasses, or a brass molder's mistake in mixing his metal so it is too hard or two soft. More oil is wasted on account of poor quality of brass than would buy a good article which would last twice as long and give satisfaction. Oil cups that feed three times too fast, or not at all, can't help the oil record, lubricators that feed ten drops a minute when throttle is shut and two drops a minute when working steam are of no use—they can be fixed to feed alike at all times Oil used when the engine is standing still is generally wasted.

Stop all the wastes and you can make a good record. Others do it

Supposen It Had Been Gone.

The "mixed" train was poking along late, and had stopped to take water and let the steam shovel take water from the engine tank—the process was slow. The passengers sat on the bank and the tie piles and told how the road should be managed.

Two elderly ladies watched the throb of the hose over in the tank hole, as the little steam pump filled the steam Irishman's tank. "They are taking water out of the engine, ain't they?" asked one lady as the gafter went by.

"Yessum"

"My! I should think the engine would be dry by this time," said the second lady after ten minutes.

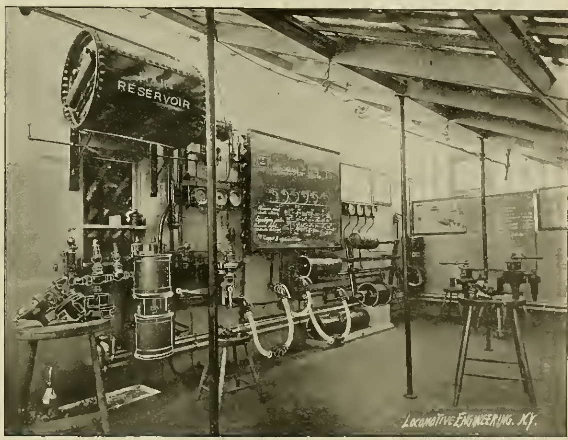
"I wonder what'd happen then," said the other

"Why, the boiler 'd bust—course!"

Just then the fireman got up and took off the the sand-box cover.

"My goodness," said the elder lady, "he's a lookin' to see if it's all gone out o' the boiler now!"

The Hall automatic block signals are now installed and in full operation on the Morris & Essex Division of the D., L. & W. road, from Hoboken, N J, to Morristown, and are doing their work splendidly. It is a pity there had to be martyrs to prove their utility, but such is ever the case This is perhaps the best example of the latest Hall signals extant, and the very officials who claimed they needed no block system on the D., L. & W are now prouder of their signals than any other feature of the road—and they are worth being proud of.



IGNORANCE EXTERMINATOR. AN INTERESTING CORNER IN THE D. & H. RAILWAY SHOPS AT GREEN ISLAND, N. Y.

LOCOMOTIVE ENGINEERING
A Practical Journal of Railway Motive Power and Rolling Stock

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Increase the Load of Freight Cars.

A subject which is of the highest importance to all the interests connected with transportation problems was very intelligently discussed at the last meeting of the New York Railroad Club through the reading of a paper by Mr W. W. Wheatley, on "How Can the Present Method of Rating Train Loads be Improved?" We are all in a general way, familiar with the fact that train loads are regulated more by guess than by calculation, but most of us required the exact figures presented by Mr Wheatley to thoroughly realize how expensive to railroad companies must be the existing loose methods in assigning loads to cars and locomotives.

The author of the paper advanced very vigorous and logical objections to the practice of rating the capacity of a locomotive as so many loaded cars without any consideration of what constitutes the load of the cars in the train. Investigation has shown that the load of a car may vary from one ton to thirty tons, and in too many instances no care whatever is exercised to see that a car carries something approaching a full load. Owing to this state of affairs great inequality necessarily exists in the weight of different trains on the same road. The most extraordinary diversity of performance of locomotives is frequently witnessed on the same road, and those immediately responsible for the work done are frequently unable to understand why a good engine will fail with a load that an inferior engine has handled successfully. The explanation is that both may be assigned the standard load of, say, forty cars, and while one locomotive is pulling 1,000 tons of freight, the other may not have more than 500 tons of load in the cars. There is urgent necessity for a reform which will introduce exact methods for indicating the loads carried by cars instead of the opinions of train dispatchers and yardmasters, who seldom inquire closely into the weights carried. A car load is generally reckoned as a full load when it does not contain half the weight for which the car is rated. A very bad case cited by a Grand Trunk representative is a sample of what is going on daily on many other roads. A car was received by the Grand Trunk from the New England under bonded seals and locks bound for Illinois. It contained a tub of butter weighing less than thirty pounds. The Grand Trunk people received 21 cents for carrying the freight over their line and were required to pay $3.75 as mileage charges for the use of the New England car. This and similar cases induced the Grand Trunk people to devote close attention to the contents of cars, and they have introduced a system of transshipping goods when cars are insufficiently loaded. In one day the contents of sixty-four cars were put into fourteen cars. In one month the loads arriving from one connection in 1,151 cars were carried away in 473 cars—a saving of 678 cars to be hauled 500 miles. It is easy to figure up the expense saved by this act of intelligent attention to details.

It is safe to assert that every railroad in the country is paying grievously for the haulage of small portions of freight put into heavy cars. A case was mentioned where the officers of a trunk line proceeded to investigate the extent of loads carried, and discovered that in the westbound cars 52 per cent contained less than 5,000 pounds, and that the average revenue tonnage in cars going in that direction was only 11,700 pounds. Many of the light loaded cars belonged to foreign lines for which heavy mileage charges were exacted. By giving the matter a little attention the percentage of cars carrying less than 5,000 pounds was reduced by half in one month. There is no reason why this little attention should not become the rule at every interchange point in the country. It would certainly result in greatly reducing the cost of moving freight. The margin of profit in freight haulage is so extremely small that it often disappears altogether, and the business is done at an actual loss. From such conditions come failure to pay interest on bonds, delay in the starting out of the pay car, and the rapid progress towards the hands of receivers. The old estimate of a particularly useful member of society was a man who made two blades of grass grow where only one had grown before. Modern railroad necessities call for men who will make one car haul the load that two cars have been employed carrying. The author of the paper believes that since the income of railways cannot be increased at present, the outgo should be diminished. The largest single item of operating expenses being the cost of conducting transportation, the efficient and economical handling of the car and train service is the true basis of successful financial operating of railways.

Steam Jackets for Cylinders.

A correspondent having written to this office for information about the steam-jacketing of steam engine cylinders, we shall devote a little more space to the subject than we could give in the Questions column. Steam jacketing of cylinders is done by casting or fitting a steam-tight casing around the cylinder and keeping the cavity filled with live steam from the boiler. The practice has been largely followed with stationary and marine engines, and a few locomotives have been tried with steam-jacketed cylinders. There is some conflict of opinion among engineers as to the value of steam jackets for stationary and marine engines, but we do not know of any one whose opinion is of any weight that advocates steam jackets for locomotives.

The steam jacket was invented and patented by James Watt, and was first applied by that famous engineer, for the purpose of checking the heat losses due to the condensation of steam inside the cylinders. Watt was one of the first to recognize that the cooling of the admission steam by the metal of the cylinder, which falls in temperature during the expansion and release periods, caused great waste of heat, and his idea was that the steam jacket would hold up the temperature of the cylinders to a point nearly equal to that of the ingoing steam. There is little doubt that with the slow piston speeds of Watt's time, the cylinder condensation was so great that the steam jacket did good service, but it does not seem to be so efficient with the faster working modern engines. Some engineers claim that a steam jacket is of no economical value under any circumstances, that the steam used in the jacket is not compensated by any saving effected inside the cylinders.

To be thoroughly efficient a steam jacket must be constantly charged with steam at boiler pressure, otherwise it is liable to be cooler than the steam entering the cylinders, in which case it will act as a condenser instead of a heat protector. Unless there are proper appliances in use for removing the condensed vapor from the jackets, the moisture will absorb heat from the cylinder metal and thereby waste steam instead of saving it. This is a thing which has happened very often, and reports of engine tests have frequently proved that the steam jacket was a source of loss. Steam jackets have been tried several times to protect the cylinders of compound locomotives, but no benefit has resulted from their use. In every case where they have been tried they have been abandoned. If it were possible to pass the hot gases from the tubes round the cylinders of locomotives without complication a saving of steam might be effected.

Disaster in Hoosac Tunnel.

A bad accident happened in the Hoosac Tunnel on the 9th of September. A freight engine went into this four-mile hole with a heavy train, and when near the center the engine broke down—report says a spring hanger—and the engineer stopped to jack up his engine. The smoke was bad, and a passenger train going the other way made it worse. The operator at the tunnel entrance "took chances;" he assumed that the train was out, or nearly out, at the other end, did not wait for a signal, disobeyed orders, and let a second train into the tunnel behind the first, consequence—a rear-end collision and three dead men. There is no excuse for the operator, but there is some lack of judgment somewhere that will let a man stop in a long tunnel for such a trivial thing as a broken spring hanger. If the engine was on the track and would pull her train (even at considerable damage to herself) she should have gone to daylight. There is almost as much danger from gas in such a tunnel as from approaching trains.

A derailing switch at the tunnel-mouth, interlocking with the signal at the other end, would have prevented the careless "guessing" of the operator.

Why will men take such chances with moving trains who would shudder at the thought of pointing a loaded gun at another employé, yet the first is a risk of the wholesale class, while the latter is a small retail business—both are bad, yea, criminal.

Whistles too Loud.

Every year or two an agitation is stirred up in some part of the country against the too free use and abuse of the whistle by men running locomotives. The most recent movement of this kind has been started by Mr. John Burroughs, the well-known novelist, whose voice has given forth a powerful shout against the noisy whistle. It seems that Mr Burroughs lives on the banks of the quiet Hudson, between two railroads, and the screeching of the locomotive whistles to the right and to the left is making the life of the novelist a burden, and indicating that the claim that a rural residence gives a quiet life to be a delusion. A complaint is made that the whistles are painfully unmusical, besides being noisy beyond the needs of signaling.

We are inclined, in a great measure, to sympathize with the complaints against the ordinary locomotive whistle, for it is generally made much louder toned than necessary. The powerful whistle used on this continent was introduced to meet a condition of railroading which no longer exists, but force of habit has perpetuated the thing after the conditions which made it useful have passed away. When single tracks were universal, when the methods for controlling the movement of trains were very crude and when fixed signals were unknown, a locomotive whistle that could be heard ten miles away, often proved useful in preventing accidents. No one claims now-a-days that the locomotive whistle is of any service in giving information that a train is five miles away. If signal men and others can hear a whistle when a train is half a mile away nothing more is required. The country is getting thickly settled along many railroads and the constantly recurring blowing of powerful whistles pitched on the most discordant notes is certainly a source of discomfort to many people. We believe that those in charge of locomotives would readily make the changes necessary to abate this nuisance if a combined and temperate movement was made to demonstrate the necessity for a change.

Cheap Labor and Hot Boxes.

A group of master mechanics had been talking about the seasonable subject of hot boxes, and there was an inclination to blame bad oil for much of the trouble. A close observer dissented from that conclusion and expressed the belief that carelessness in connection with the running gear had more to do with hot boxes than people were willing to admit. In many engine houses, he said, the cheapest quality of help is employed in adjusting running gear and in repairing defects to the same and the stupid things naturally done cause more expense from hot boxes than would pay three times over for a superior class of workman.

When an engine is fitted up in the shop every care is taken to have the parts adjusted so that the weight will rest on the boxes as evenly as possible. The engine goes out, and after a while comes in with a broken driving spring. The broken spring had eleven leaves, but there are none of that kind at hand, and a spring with twelve leaves is put in. The pressure on the boxes is now out of adjustment and one runs persistently hot. It is finally taken down, and a new brass put in thicker than the others, and this aggravates the evil, and the engine gets a bad name for causing delays on the road, while everybody having anything to do with it has his temper ruffled, and recriminations are often exchanged that lead to personal enmities. The engine house forema examines the engine and can see nothing wrong, and blames the engineer. The engineer is certain that he has not neglected the boxes, and resents attempts to blame him. Suspicion is thrown upon the quality of the oil and upon the kind of brass supplied, but no one searches backward into the true cause of the disorder.

This kind of disorder frequently originates with a broken spring hanger which is replaced by one shorter than the original. The result is about the same. Sometimes it is the truck bearings that are thrown out of adjustment by renewal of parts that are larger or smaller than the others. The personal inconveniences that result are the same. The moral of this is keep your eye on the laborers employed to do running gear repairs.

Heroes of the Great Fire.

The recent awful forest fires in Minnesota and Wisconsin showed up some railroad heroes—as trying times always do.

A train in charge of Conductor Sullivan and pulled by Engineer Jas. Root, nearly reached Hinckley, Minn., when several hundred panic-stricken people rushed on board. The forest beyond and the town were on fire.

Although the train stopped but a few moments, the cab of the locomotive and the baggage car took fire from the intense heat and could not be put out. Despite this, Root backed his blazing train six miles to Skunk Lake.

Before reaching there the entire train was on fire; many had jumped to certain death in frantic efforts to escape the torture.

When the lake was reached Root was awfully burned, but he was calm and had the satisfaction of seeing some hundreds of people, whose lives be had saved, plunge into the lake.

With all his bravery, Root and his entire train of people would have perished had it not been for the heroic acts of Fireman John McGowan.

Men like Root are not uncommon, they sit behind throttle valves on every road in the land, and when the emergency comes they are there—they are heroes of a day and are then forgotten.

Had "Jim" Root led a squad of soldiers that killed 400 men instead of having saved that many lives alone, he would have had the thanks of Congress, a gold medal and a monument.

He deserves something better than a monument—and so do all his comrades.

We are in receipt of Vol. I., No. 1 of *Machinery*, a new paper in the mechanical field. In size the pages are 7 x 11 inches and there are twenty pages of reading matter. The initial number is a very handsome one typographically, and seems to be level full of matter interesting to mechanical readers. Fred. H. Colvin, a practical machinist, who is not unknown to our readers, is editor, with W. H. Wakeman and W. L. Cheney, associates, and the illustrations are in charge of F. W. Jopling. We would think more of their proof reader if he would not abbreviate the name of this paper. The publishers of *Machinery* evidently appreciate the fact that advertisers are commencing to take note of the circulation of trade papers, as putting their subscription price at fifty cents per year is evidently an attempt to get a large list quickly. We wish the new venture success; there is room for good papers everywhere. If the owners of this one make a good paper they will have clothes to wear and eat pie, if a poor paper is offered no one will find it out so soon as the publishers. *Machinery* is launched by the Industrial Publishing Co., owners of *Railroad Appliances* and the *Price Current*, whose place of business is at No. 411 Pearl street, New York.

NEW BOOKS.

STEAM TABLES AND ENGINE CONSTANTS. By Thomas Pray, Jr. D. Van Nostrand Co., New York. Price, $2.00.

This book contains a great deal of valuable information for the mechanical engineer, much more than the modest title seems to imply. The need for such a book was brought home to the author during years of active practice in steam engine tests, and it is arranged in the form deemed most convenient for reference. The book is not a compilation of old tables, but is newly computed, and as far as we can find is very accurately done. Besides the tables there are some thirty-five pages of text matter relating to steam engineering put in very clear, concise and comprehensible shape. Among the subjects that information is given on are: Ratio of expansion, cut-off, etc.; Factors of evaporation; Economy of feed-water heating; Heat of steam; Hyperbolic logarithms; Pressure, temperature, volume and density of steam, and a variety of others of equal importance. The book will be found of much service to every engineer interested in steam and heat problems.

Mr. John W. Cloud, secretary of the Master Car Builders' Association, has sent out a circular intimating that lithograph copies of the latest revised standards and recommended practice may be had from his office, Rookery Building, Chicago. The sheets are 30 x 38 inches, and are sold for 25 cents each. The proper way to keep standards standard is to use these drawings, which are perfect and admit of no mistakes.

The Q. & C. Co., of Chicago, have issued a pamphlet containing a digest of all the State laws on cattle-guards and fences.

Interchange of Cars in Europe.

[EDITORIAL CORRESPONDENCE.]

A surprising amount of thought and labor has been devoted in America to the devising of a system of car interchange which would be equitable and just towards all who send cars upon foreign railroads and towards those who receive them. The annual discussions at the Master Car Builders' conventions, and the disputes that have to be settled at every meeting of the Arbitration Committee supply convincing evidence that our system of car interchange is far from being perfect or satisfactory. The conditions of railway freight transportation in America have peculiarities not to be found elsewhere, but it seemed probable that the rules and practice followed in the interchange of cars in European countries might furnish suggestions that would be useful to those having charge of our interchange system. With this idea in mind I inquired closely about the system of car interchange followed in every country where I traveled. There was very little learned that would be of practical value to our people, but it may interest our readers to know how car interchange is carried on abroad.

The first system inquired into was that followed in the British Isles. They have in these countries an institution called the Clearing House, which takes away from railroad officers all the annoyances that arise with us from disputes in the interchange of cars. This Clearing House manages the whole of the details connected with the interchange of all railway business. When passengers or freight is passed from one line to another, the originating line has nothing to do about the settlement of the proportion of payment that goes to the connecting lines. All that is done by the Clearing House, and the same institution supervises the movement of cars from one line to another.

At every interchange point there is a Clearing House inspector who examines the cars and notes their condition. If a car, or wagon, as such vehicles are called abroad, has any defects they are noted. If repairs are necessary they are executed at the expense of the owners of the car. If the car receives damage while on a foreign line, the company doing the damage is charged with the expense of effecting the repairs. But the spirit followed in the interchange of cars is that the owner is responsible for breakage to parts of cars when they are not the result of accidents. The breakage of draft attachments is charged to the road where such breakage happen.

When a car is sent upon a journey that takes it over one or more foreign roads a fixed time is specified in which it has to be returned. The road that receives a car is held responsible for its safe return. When a car exceeds the specified time in getting back, demurrage is strictly exacted to pay for the delay. The Clearing House manages all the details of reporting how long a car has been subject to demurrage and collects the amount from the company at fault and pays it to the other one. In consequence of this the railroad companies are exceedingly prompt in returning foreign cars.

Thirty years ago, when I was in train service in the British Isles, I remember that if anything happened to the engine of a freight train which required putting off part of the train, perishable goods and foreign empties took the preference in going forward. If our cars were returned as promptly as foreign railroad cars go back to the owners, we would not hear so much about scarcity of cars in busy times.

The conditions of car interchange on the Continent of Europe resemble ours to some extent, and there are rules in force which our people might adopt with advantage. They have no Clearing House, and the individual companies have to watch that their cars get fair treatment on interchange lines. The first principle of the rules of interchange is that a company receiving a car must return it in the same condition as it was when received. The government control of the lines makes inspection more satisfactory than it is with us, for the inspectors are officials who have no unfair leanings on either side of the place where they work.

As in England, a car is allowed a certain time for the distance it has to go, and if it does not get back in time a demurrage charge of sixty cents a day is exacted and paid. As the cars are of less than half the capacity of our cars, the charge is high enough to cover the price of the car should it remain long away from home. As a car has to be returned the same way as it went, and as the receiving company is responsible for its safe and prompt return, there is no stealing of foreign cars to keep them on construction all summer.

Although the rule is to return cars in the same condition as they were in when received, the good sense of the men in charge of the rolling stock of the several lines has brought about an arrangement which saves a great deal of annoyance and correspondence. They found by examining the records extending over many years that the charges for repairs of foreign cars were mostly for trifling sums, and that the debits and credits nearly balanced. That is, the charges made by, say, the Chicago & Northwestern against the Lake Shore for car repairs would nearly balance the charges of the latter road against the former for similar services.

This being proved, the mechanical superintendents of the French railways agreed that no charge should be made for repairs that did not exceed $60. This change has done away with a vast volume of correspondence, and all concerned are said to be much better satisfied than with the old plan, which is the practice our roads still follow.

In Austria, Germany and Holland they work on the principle of a car being returned in the same condition as it was when received. In Germany they are trying to arrange a plan of repair charges similar to that followed in France. In all these countries demurrage charges are strictly enforced for delay of cars.

I questioned the mechanical superintendent of the largest line running into Warsaw about how car interchange was carried on in Russia, and he said that when they gave a car to a connecting road they got another in exchange, and kept it till they got their own one back. He did not appear to see how they could possibly ever get their cars back if this hostage plan were not followed. He did not seem to understand about the system of charging other companies for car repairs.

There was a photograph in his room showing a bad wreck, with several cars smashed up. He said that it did not happen on his line. "Now," I said, "suppose some of these were your cars. How would settlement be made?" "We should keep the cars we have belonging to them until our cars were returned," was the reply. The plan is, at least, simple. A. S.

Some of the railways in Germany are using chilled cast iron wheels under their freight cars that have no brakes. The wheels look very much like those made in America, but there is very little confidence in their reliability, although we could find no report of breakage. Railway material is supposed to be much cheaper than it is here, but most of our wheel makers would be glad to supply wheels at the prices paid. The Kaiser Ferdinand's Northern Railway, of Austria, uses cast iron wheels and pays 32 florins per wheel, which is about sixteen dollars. The wheels are not more than 600 pounds weight.

Mr. Jas. F. Blackwood, who has been general foreman of the South Carolina & Georgia shops at Charleston, S. C., has been appointed acting superintendent of motive power *vice* E. M. Roberts, resigned. The management could not do better than confirm this appointment. Mr. Blackwood is the right man in the right place.

PERSONAL.

Mr. J. H. Berry has resigned as master mechanic of the Cincinnati & Sandusky division of the C. C. C. & St. L.

Mr. S. Gano, Jr., has been appointed general manager of the Addyston & Ohio River, with headquarters at Cincinnati, Ohio.

Mr. H. D. Norris has been appointed purchasing agent of the Flint & Père Marquette, in place of Mr. E. F. Weld, resigned.

Mr. Lewis M. Hamilton has been appointed general superintendent of the Cumberland & Pennsylvania, with headquarters at Cumberland, Pa.

Mr. James A. Keegan has been appointed master mechanic of the Cincinnati & Sandusky division of the C. C. C. & St. L., with headquarters at Delaware, O.

Mr. J. H. Foster has been appointed superintendent of the James River division of the Chicago, Milwaukee & St. Paul, with headquarters at Aberdeen, S. D.

Mr. W. S. Rogers, lately air-brake instructor on the D. & H., has been appointed superintendent of the shops of the Snow Steam Pump Works, at Buffalo, N. Y.

Mr. E. W. Knapp, foreman at Monterey, on the Mexican National Railway, has been promoted to the position of master mechanic in charge of the Acambaro shops.

Mr. J. B. Caven, general passenger and freight agent of the Valley Railway Co., and one of the best known railroad men in Ohio, was murdered in Cleveland last month.

Mr. F. G. Lauer, foreman of locomotive repairs of the Buffalo, Rochester & Pittsburgh, at Rochester, N. Y., has been appointed master mechanic of the road at that place.

Mr. L. H. Sherman has resigned as master mechanic of the Santiago shops, Mexican National Railway, City of Mexico, to take a better position with the Guadalupe Mining Co.

Mr. Robert Dewar, master mechanic of the Mexican National, at Acambaro, has been placed in charge of the Santiago shops of that road in place of L. H. Sherman, resigned.

Mr. J. P. Bay has been appointed superintendent of motive power and machinery of the Denver & Gulf divisions of the Union Pacific, with headquarters at Denver, Col. His jurisdiction is also extended over the South Park road.

Mr. F. C. Webb has been appointed division superintendent of the third, fourth and fifth districts of the Union Pacific, Denver & Gulf R. R., with headquarters at Denver, Col. Mr. Webb was formerly with the Chicago & Alton.

Mr. H. M. Laird, chief car inspector and foreman of shops of the Nashville, Chattanooga & St. Louis, at Atlanta, Ga., has been appointed master mechanic of the Southern Iron Car Line, with headquarters at Atlanta.

Mr. S. D. King, for several years purchasing agent and superintendent of stock of Pennsylvania Coal Company, at Pittston, Pa., has been appointed superintendent of motive power of the Erie & Wyoming Valley road, with headquarters at Dunmore, Pa.

Mr. Joseph F. Kirchgraber has been reappointed traveling engineer of the Gulf divisions of the Union Pacific. The position was abolished for a time, but the company [illegible] taking off the pay of a traveling engineer did not reduce expenses—quite the contrary

Mr J M Barr has resigned as division superintendent of the Chicago, Milwaukee & St. Paul, at Chicago, and has been appointed superintendent of the Breckenridge division of the Great Northern with headquarters at Willmar, Minn, taking effect September 1st

Mr. Albert Griggs has been appointed assistant superintendent of the Chicago & Eastern Illinois, with headquarters at [illegible], Ill. Mr Griggs was formerly superintendent of motive power of the [illegible] York & New England, and is one of the best known master mechanics.

Mr E T Horn, formerly superintendent of the Macon & Brunswick divisions of the East Tennessee, Virginia & Georgia, and recently appointed trainmaster of the Southern Railway, at Atlanta, Ga, has, it is stated, been appointed general manager of the Macon & Northern, with headquarters at Macon, Ga

Mr W A Vaughan, who has been for [illegible] years general superintendent of the East Tennessee, Virginia & Georgia, has been appointed superintendent of car [illegible] of the Southern Railway. Mr. Vaughan was for many years on the Michigan Central and was exceedingly popular [illegible] superintendent.

[illegible] Gleason left New York for Brazil [illegible] of September, to superintend [illegible] of the [illegible] engines building [illegible] Brooks This is Mr. Gleason's third [illegible] the tropics His twenty years' ex[illegible] insure his success in erecting the [illegible] and setting them at work, and we [illegible] trips have insured his life [illegible] "yellow jack," small-pox and fleas.

[illegible] the new organization of the [illegible] Railway Mr R D. Wade, superintendent of motive power, has had his [illegible] extended over what was [illegible] the East Tennessee, Virginia & [illegible] system Mr W H Thomas, [illegible] superintendent of motive power [illegible] East Tennessee system, has been [illegible] assistant superintendent of motive [illegible] the whole Southern system

[illegible] Warman, the ex-engineer poet, who [illegible] a "pay streak" in his song "Sweet Marie," has gone to Europe for *McClure's Magazine* and taken the original Sweet Marie with him. Cy wrote up a trip on the engine of the Empire State Express from New York to Chicago that gave him a little reputation for that kind of thing, and he goes to Europe to write up a trip in the engine room of a fast ocean steamer.

Mr C E. Schaff has been appointed assistant general manager of the Cleveland, Cincinnati, Chicago & St. Louis R R For several years past he has been assistant to President Ingalls, and his intimate knowledge of the business has commended him for promotion to the position he now holds Mr. Schaff has a very intimate acquaintance with all the details of railway work, for he commenced railroading as a brakeman on the Pan Handle, and successively served as fireman, conductor, yardmaster and trainmaster. He was for a time general superintendent of the Peoria & Pekin Union.

Mr E M Roberts, superintendent of motive power of the South Carolina & Georgia R R, has resigned that position. He had been head of the mechanical department since 1891 and effected very great reforms in the service he had charge of. He is certainly one of the ablest of our younger class of master mechanics, and the officers of the S. C & G R R. testify very warmly concerning his ability and admirable management of his department Mr Roberts has been a very industrious worker on committees of the Master Mechanics' and Master Car Builders' Associations, and has been in the habit of doing special work to obtain information for the committees he was connected with.

One of the best known of the older school of railroad managers in the West passed away when Mr. John C. Gault died last month, in Chicago, from a stroke of apoplexy. Twenty years ago, when Mr Gault was assistant general manager of the Chicago, Milwaukee & St. Paul, he appeared to be on his way to enjoy the very highest honors in railroad service. At that time three out of four railroad men in the West, if asked who was the best railroad man in the country, would have answered John C Gault. He was drawn away by Mr Gould from the St Paul to manage the Wabash, at a salary of $18,000 a year, which was considered exceptionally high at that time. His latest railway work was on the Cincinnati Southern, where he was for five years general manager.

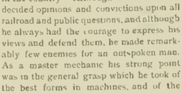
Mr H W. Caldwell, president of the New York, Chicago & St. Louis, has been appointed general manager of the Lake Shore & Michigan Southern, and will be elected president to succeed Mr. Newell when the board meets. The successful manner, in which Mr. Caldwell has managed the Nickel Plate road has commended him to the Vanderbilts as a suitable man for the important business of managing the Lake Shore He is 64 years of age, but is a well preserved man. Of fine executive ability he puts upon others the working out of all details of management, and does not burden himself with work that can be done by subordinates He is a graduate of the Pennsylvania system, where he passed through the engineering department and rose to be general manager of the Pennsylvania lines west of Pittsburgh The Lake Shore people are to be congratulated on the kind of successor they have got to their president.

Mr. John Newell, president of the Lake Shore & Michigan Southern, died suddenly in the end of August, having been stricken with death while riding in his private car, where he spent the greater part of his time. The most conspicuous monument which Mr. Newell leaves behind him of a life well spent, is the condition of the railway which he has managed for eleven years. It is now in a better position to haul passengers and freight at low cost than any other railway on this continent, and this condition is principally due to Mr. Newell's sound ideas concerning track and machinery. Like many other railroad managers who have passed away, Mr. Newell worked himself into his grave by striving to do more labor than nature allows one man to accomplish. He knew no pleasure but what pertained to duty, no pastime that did not involve thoughts of his business Mr. Newell was a Vermont man and began his life's work as a rodman in an engineering corps that was surveying part of the Cheshire Railroad. By the time he reached manhood he had gained some reputation for ability as an engineer, and was in charge of important work. His strong characteristic was untiring industry. That with decided aptitude for the work soon elevated him to a high position in his profession He had a very wide railroad experience and was for a time president of the Illinois Central before going to the Lake Shore.

James N. Lauder.

Few of the persons who attended the last Master Mechanics' Convention, at Saratoga, failed to note with sadness how fearfully the old stalwart lion of debate, James N. Lauder, had dropped from his ancient vigor within the year. The shadow of death appeared to cling to his face, and his voice, so strong and fearless in the past, had taken a feeble tone which indicated painful loss of force. Only the power of an indomitable will prevented the man from remaining at home in bed. His friends who parted from Mr. Lauder in those closing days of June will not be surprised to learn that in the last days of August his life ended.

Mr. Lauder was one of the best known and most popular railroad mechanical men in the country Although a man of most decided opinions and convictions upon all railroad and public questions, and although he always had the courage to express his views and defend them, he made remarkably few enemies for an outspoken man. As a master mechanic his strong point was in the general grasp which he took of the best forms in machines, and of the best methods of organization in management. He was not strong on details, but no eye could more quickly detect the weak points of any mechanical appliance offered for adoption, and how vigorously he would explain to an inventor the shortcomings of the device he was offering to



railroad men. But he was equally keen to appreciate the merits of a good thing, and many a device now recognized as essential attachments of locomotives and cars was helped into popularity by commending words from Mr Lauder. As a designer of locomotives Mr Lauder had few peers, and his influence in favor of proper proportions did much to improve the engines over the whole country. He was one of the first men to recognize that there was a tendency among our designers to make the boilers too small for the cylinders, and his voice sounded out the doctrine that the boiler, not the cylinder, is the measure of a locomotive's capacity. This he proclaimed for years, when his sympathizers were not numerous; but they grew in strength, until nearly all our master mechanics and locomotive designers became converts.

James N. Lauder was born of Scotch parents, in Vermont, in 1838. He learned the machinist trade in a country machine shop, and shortly after finishing his apprenticeship he went to Altoona, Pa., and began work in the Pennsylvania Railroad shops, where his uncle, Mr. Laird, was superintendent of motive power. He had not the elements of a man that would cling to the coat-tails of an uncle or of any other man as an aid in moving upward, and so, after a few months spent in Altoona he returned to New England, and went to work gaining experience in the business. In the shops of the Northern Railroad of New Hampshire, at Concord, Mass., he rose to be foreman, and from that was appointed master mechanic in 1865, a position which he held till 1881, when he was appointed general master mechanic of his old road and the Boston & Lowell, which consolidated. The courts broke up the consolidation, and Mr. Lauder left the companies and went to Mexico to be superintendent of motive power of the Mexican Central. This position he held for two years and then returned to New England to be superintendent of rolling stock of the Old Colony, a position he held at the time of his death.

In 1870, Mr. Lauder joined the American Railway Master Mechanics' Association, and from the first was one of its most active and energetic members. In 1881 he was elected president, and held the position for two years. On his election the second time he made a strong speech against the president holding the position longer than two years. He was president of the New England Railroad Club for two years, and was held in high esteem by every society where discussions of railroad mechanical subjects caused his voice to be heard. We know of no one whose voice and counsel will be more seriously missed when master mechanics and master car builders come together to reason about their common interests.

On September 2d, at Augusta, Ga., Mr. Henry G. Rowarth, the oldest locomotive engineer in America, died. A portrait of Mr. Rowarth appeared in this paper for December, 1892. Mr. Rowarth entered the employ of the South Carolina road in 1833 and began running an engine in 1834, putting fifty years in this service. He was engineer of the "Best Friend," the first locomotive for actual service built in the United States

EQUIPMENT NOTES.

The Mexican Central are in the market for 250 cars.

Baldwins are building some narrow gauge locomotives for the government of Japan

The Merchants' Dispatch Co are reported to be inviting bids for the building of 250 refrigerator cars.

Cooke's people are making six new fireboxes for the New York, Ontario & Western, of Schoenberger steel.

Flint & Co., of New York, are reported to be authorized to order 700 cars for the Central Railway of Brazil.

The Rhode Island Locomotive Works are doing a great deal of heavy repairs to locomotives belonging to the New York & New England Railroad.

Rumor has it again that the Savannah, Florida & Western are about to order some new locomotives. Rumor also says that a great many railroad managers are anxious to increase their car equipment if they could only see their way to pay for building the same.

The Boston & Albany have ordered fourteen eight-wheel passenger engines from Schenectady. They will be the standard engines of the road. Nine of the boilers will be carbon steel and five of Schoenberger steel. Latrobe tires are specified, and steel for the piston rods made by the Coffin toughened process.

The Illinois Central have ordered eighteen new locomotives, of which ten are moguls with cylinders 19 x 26 inches, and eight are eight-wheel passenger engines with driving wheels 62 inches diameter. Carbon steel has been specified for part of the boilers. The moguls will be built at Rogers and the passenger engines at Brooks. Krupp tires are specified for the passenger.

The headlight equipment of the Brazilian suburban engines is a special feature. Each locomotive is supplied with two 20-inch headlights, constructed for burning Pintsch gas in a powerful Argand burner, one light being located in the usual place and one on top of the tender tank The signal lights, of which there are four, are also arranged for burning Pintsch gas, and the cab is illuminated by a small Pintsch lamp. The supply of gas is carried in a tank hung below the floor of the cab and between the side frames of the tender. The Pintsch gas headlights are much more powerful than oil headlights, the locomotive engineers witnessing the recent tests made in the yards of the Delaware, Lackawanna & Western Railroad, at Hoboken, stating that the light was at least three times as powerful as that of similar oil headlights, and at the same time it did not in any way obstruct the clearness of the signal and other lights about the yard, which is a very serious objection to the use of electric headlights. Pintsch gas headlights have been in use on locomotives in Europe and South America for several years with excellent results. Why not in this country?

Practical Letters from Practical Men.

Facts Wanted. There's a glut of Opinions.

Write on one side of the paper, state your point plainly and briefly, and then quit. We supply the generalities. No letters noticed unless name and address are annexed.

An Engineer's Opinion of Independent Driving Brakes.

Editors:

There seems to have arisen in the past year or two a great deal of prejudice against the "independent driving brake" and a great tendency to change all such brakes, be they steam, vacuum or air, to dependent brakes, that is to work driver, tender and train brakes with one action of valve. Now I do not think any first-class practical engineer ever suggested such a change, and it would seem to my, perhaps narrow brain and mind, that an engineer, if at all bright, in regard to train and engine brakes, would be the proper man to to make necessary suggestions in regard to changes, improvements, etc., as to the best manner of having brakes connected for efficient handling. While I rather favor a dependent brake for passenger service on account of fast time, shorter trains and equipment in good shape, besides a general quicker action, I feel positive that for heavy freight or switching service an independent driver brake is far in advance of one that is cut in and works with the one brake valve, for many reasons which I will state. I am greatly in favor of any change or improvement that will tend to lessen the dangers of running heavy trains on fast time or slow time either, for there is, of course, danger in both, but I certainly fail to see where anything is gained whatever by having driving brakes on freight engines cut in with the train and handled with one valve. If an engineer takes any interest in his engine at all he will not object to the slight additional care of one more valve, especially when that valve helps him in so many different ways to make smooth stops, etc. Say, for instance, I am using a steam-driving brake on engine, and have tender equipped with air. I am called to go out with a train of forty cars, all air. I have two or three switches to make, and I dislike plugging an engine (especially if I am trying to be light on valve oil), and I want a heavy pressure to accumulate in main reservoir to charge those forty cars and get out of town. How nice it is to leave valve on lap and not charge tender auxiliary up to sixty or sixty-five pounds while doing the switching, and still have a power to stop engine without reversing, also how easy to run up to a car and couple on with the independent driving brake, without releasing or reversing engine. Steam is so much quicker, can be applied and released quickly or slowly or like straight air, partially, that it is possible, if stopping two or three feet short of car, to partially release just sufficient to let engine move up to car and couple on, while if the grade was steep and driving brake cut in with train brakes I would have to release for those two or three feet, and unless I wanted to waste a lot of air, by using emergency port would have to reverse engine or bump the car a little too hard. I hear some critic say why not kick tank and driver brake off and just let enough air from reservoir to train pipe to push up triple piston and set again. This, of course, can be done, but the pressure in auxiliary is equalizing down less all the time that is being done, and if many couplings are made you will soon have her over to give auxiliary a chance to charge. Again, I am going down a grade with my forty loads, and I have to stop and take water at a tank where engine can't back up twenty cars. My judgment is not good enough to stop right at the spout always, and I dare not go by a foot, so I am stopping a few feet short. How to release those forty brakes on this grade and move ahead and set brakes with valve in service position? I will be several feet past the tank before I can get what air out of train pipe I had to let in to push up piston, and release brakes. Of course, if auxiliaries could be re-charged as quick as brakes could be released, this problem would be easy, but the feeding port past triple valve piston will not of course admit of this, on account of its small size (and, by the way, a good many men do not understand why it is so small), therefore we have to figure different. Now, then, even with the dependent brake this stop can be made, and without reversing engine or using emergency, but it is injurious to cars, and for that reason I dislike the practice—that is, by kicking off head brakes. The independent steam or vacuum brake on drivers does away with this difficulty very simply, as it can be set and hold weight of engine against train, when head brakes can be kicked off to our heart's content, and leave no chance of breaking in two, or if a full release is made with the independent brake, we can hold slack back and it will give us time to make a service application before we get by.

Again we are pulling out of a siding that is slightly down grade, our pump is blowing through and we do not wish to make any more applications than is absolutely necessary, with the independent brake train can be steadied so brakeman can throw switch and get on without train coming to a full stop, result—time and air both saved.

Again we are heading in on siding where there are cars standing, and we have to approach and couple on very carefully, as we have a pilot bar to couple with, and we do not wish to stop and start forty cars very often if we are in any hurry. Here is where our independent brakes or drivers come in again, as we can leave it set to hold slack and couple on without stopping until coupling is made. I could give many more reasons why an independent driver brake is the best for freight service and on switching engines, but will lay low for criticisms. I believe the main reason why independent driver brakes are being done away with on many roads is that some engineers won't use them enough to keep them in shape. My idea is, that it is the engineers of that kind, and not the independent brake, that should be done away with. An engineer who takes so little interest in an engine that he won't take care of every improvement that is put on for his benefit, or for the benefit of the company he is working for, should be made to do so or resign. This in all kindness and candor. If our traveling engineers would educate engineers a little more in the use of independent driving brakes there would be no earthly reason for changing to dependent brakes.

L. D. SHAFFNER.

Anaconda, Mont.

[Our correspondent is like many other engineman, but he is too late with his argument—the independent driver brake has gone, never to return, and it is well that it has. The engine is the heaviest part of a train and the most efficient place to brake. When independent driver brakes are provided, the train has to stop the engine in nine cases out of ten, and great damage is done to draft rigging on account of it.

The independent driver brake is handy for yard and tank stops, but since the introduction of the automatic from pilot to caboose, many men who said "It couldn't be done," are making gilt edged stops with it. The only thing for the first-class engineer to do is to study the brake as it is—it has come to stay.]

Increase and Decrease of Lead with Shifting Link.

Editors:

I am much interested in your paper, for I think you are doing a good work. I note an error in your September issue in your reply to Queenslander, of Maysborough, Australia, which was doubtless due to haste. You say, "In every arrangement of the shifting, or Stephenson link, the lead increases as the lever is hooked up." That is true as the motion is usually arranged, but the motion can be arranged on any ordinary locomotive without change of parts or making anything new, so that the lead will *decrease* as the lever is hooked up. Still another adjustment will give a constant lead for one motion (the forward is best), and a lead which diminishes from the center to full gear on the other motion.

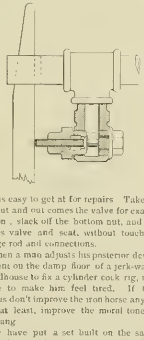
Scranton, Pa. TOWNSEND POORE.

[Perhaps we should have said "In any *usual* arrangement of the link." The motion can be distorted to do as our correspondent says, but is not done for service. It would be just as fair to assume that the shifting link had a constant lead because the lever could be left in the corner. As a matter of fact it could be so left, but is not in practice.]

Improved Cylinder Cock.

Editors:

Acting on a hint in the September number in regard to improvements in locomotive details, I inclose tracing of cylinder cock.



It is easy to get at for repairs. Take off top nut and out comes the valve for examination, slack off the bottom nut, and out comes valve and seat, without touching wedge rod and connections.

When a man adjusts his posterior development on the damp floor of a jerk-water roundhouse to fix a cylinder cock rig, it is liable to make him feel tired. If this dingus don't improve the iron horse any, it will, at least, improve the moral tone of the gang.

We have put a set built on the same principle on a hoisting engine, but with this alteration from the chief draughtsman, using a T for the body.

WM. O. MOODY.

Chicago, Ill.

Some More Air Brake Ruts.

Editors:

The tendency to keep in the same old rut is not confined to those who use air brakes. The manufacturers have kept up with the times and deserve and receive credit for their continued improving, and the air brake is now practically perfect, but they are not altogether clear of the rut. How long it was that they continued to furnish that reducing valve for the train air signal, Plate D 28, Fig. 3. It is seldom that anything gets wrong with it except with the supply valve, and it is continually acting. If a little bit of dirt gets between it and its seat the signal line will be charged with full main reservoir pressure, and engineers know how confusing the signals are then. When the brake is released, after stopping at a station, the air whistle shrieks out the signal to "go ahead," and thinking that he has stopped too far back, the engineer pulls ahead and turns over a truck load of trunks and a few passengers, but he got the signal all right and obeyed it.

The Westinghouse Company now make a reducing valve something similar to the feed valve attachment of the new engineers' brake valve, and is intended to be placed in the cab. After leaving a station the engineer can close a stop cock and shut off the pressure from main reservoir, take off the cap of the reducing valve, take out and clean the supply valve, replace it and have the signal line in working order before whistling for the next stopping place. The supply valve in the old style reducing valve cannot be taken out without disconnecting its piping and removing it from the main reservoir, and this represents an hour's time for the ordinary repair man, while with a properly designed and located valve the engineer could remedy the trouble in a few minutes at no cost, and with the benefit of correct signals the remainder of the trip.

The Westinghouse Company furnished those old valves years after their faults were plain, and they were known to be a constant source of trouble, and when the New York Company got out their air-signaling apparatus, they imitated and fell right in the same rut, then the Westinghouse people got out of it.

It would be a saving in the end to throw away the old reducing valves and buy the new ones; instruct engineers as to keeping them in good condition, and hold the engineers responsible for it.

I have never known the conductor's brake valve being any where on a passenger car except in the closet. It is put there because the brake company recommended it. The car builders thought it a convenient place, and as nothing seems to have happened yet to give reason for changing its location, it is always placed in the closet.

We had the same three cars on a local passenger run all summer and for several days there was a bad leak somewhere in the train pipe that could not be located by either the trainmen or inspectors, and it was all that the 6-inch pump could do to furnish pressure enough to make the frequent stops; finally a farmer from Pecksburg told the conductor that "there was a thing about to bust in the closet." The conductor's valve, one of the old ones, was dirty and leaking badly. If it had been outside of the closet the leak would have been noticed sooner.

Suppose that an extremely nervous person or a lady in a delicate condition was in the closet when the conductor's valve was pulled open. Or a mother might be attending to her infant when the valve opened, and be so frightened as to drop the child to the track beneath. It looks inhuman, and having the conductor's valve in the closet may prove expensive to some railroad company eventually.

After the conductor has applied the brake and stopped his train, it is necessary to close the valve and get the brakes released. It must often be done quickly, as other trains may be following closely, and if the closet is occupied, the person there may have the safety of the trains in his hands, for it takes some time to bleed off all the brakes when the train pipe is empty, and the fullest explanations will be necessary to make the passenger understand that he can unlock the closet door without sacrificing any of the rights he secured when he paid his fare.

I never saw where the exhaust air from the conductor's valve was piped out of the closet, and most roads still use some of the old valves that have to be held open. Some roads do not cord the valves, when the closet is occupied the door is usually locked on the inside, and an emergency would be past before the conductor could gain admission.

It is a general rule or custom to lock the closet doors on approaching terminals and some other stations, and if the conductor wants to pull the air while going through the yards, he must unlock his valve first, if it is not corded.

The car discharge valve for the train air signal is outside and at one end of the car, wouldn't it be getting out of the rut to place the conductor's brake valve outside at the other end of the car.

There seems to be a general impression that the air brake companies are behind the times in not exchanging their plain form of angle cocks for some complicated mechanical absurdity that will perform impossibilities—such as being able to distinguish between a railroad employé and a villain—it must have brains for that. It is not likely that the angle cock will be changed; it will remain as it is, or be entirely abandoned, and the latter is safely possible.

Thirteen years ago the Westinghouse Air Brake Co. patented, and for a while manufactured, a hose coupling, the use of which obviated the necessity of having angle cocks at the ends of the train pipe. The coupling contained a valve that would open when a pair of them were united, and close when separated by hand; but if parted by a straight pull, as when the train breaks in two, the valves would remain open, allowing the train pipe air to escape and apply the brakes. This form of coupling was illustrated and described in the Westinghouse Instruction Book for 1881, and if it was in general use there would be no need for angle cocks. It seems to me that this is the only remedy. Of course there is room for argument. The Westinghouse pattern of '81 would not do now; its valve does not open and close automatically when united with a plain coupling, but one could be made that would, and with better designed valves that would not be so easily deranged by dirt, snow or ice, and with a check valve in the angle fitting that would close when the hose nipple was removed, the angle cock difficulty would be settled.

In my letter in the September number one paragraph was made meaningless by a change in the punctuation and a sentence divided. It should read: "If high excess pressure is carried, an 8-inch pump will give as good service as a 9½ inch pump, but with little or no excess the pump is the main factor in releasing brakes on a long train after an emergency application," etc.

WILL W. WOOD.

Terre Haute, Ind.

Old and New Brake Valves Volume vs. Pressure Leaks.

Editors:

Will W. Wood in September number devotes considerable space to an article headed "Getting Out of the Rut." The article is very good, but is in some places somewhat misleading, I think. He states that "one bad feature of the old valve is that an extremely high pressure may accumulate in the main reservoir, and burst hose or start leaks in the train pipe when the brake is released." On another page he states "his theory of high pressure has been unfavorably criticised and a larger volume proposed instead." He then states "this may be accomplished by carrying a higher pressure of air in the main reservoir, and he would like to have some one give one good and sufficient reason why this should not be done." Will, you have given one very good reason yourself, and in my estimation the main reason, that is, that heavy reservoir pressure, when turned into train pipe, is liable to burst a hose or cause leaky joints, and in this era of hurry up we can't be bothered with delay that can be avoided. And if, as you advocate, we set governor at 120 pounds for main reservoir we will very often be delayed by hose bursting, etc. Now, Brother Wood, our idea is, use large main reservoirs, if half as large again as is generally used so much the better; then you will have the volume to recharge with. Carry 60 pounds train pipe pressure, and, if you have an 1892 valve, set governor at 100 pounds and mainly have a brake piston travel of not more than seven or less than six inches. Right here is the main part of the brake equipment, and that does not receive the attention it should, and on forty and fifty car trains it makes a very pleasant stop if you happen to have cars ahead with medium and long travel, and behind ones with six inch, especially if engines is not equipped with independent driver brake. I also differ from friend Wood in regard to the '92 valves for long trains, especially where the number of cars differ every trip. I prefer for long trains the 1890 *D 8* valve, as it does away with adjusting governor for different lengths of train, and as far as the feed valve attachment goes it should be unnecessary, as there should be no leaks in train pipe, and if engineers and car and or air inspectors understand their business there will not be any leaks that require the attention of feed valve. The new governor and pump, however, are necessary, and splendid for any service. Brother Wood speaks of trains moving off while standing at coal chutes, etc. They must not look after piston packing very sharp on your road, Will, as trains of that kind would not do in this mountain region, where retainers are used, and of course depend on tight piston packing in brake cylinder. Brother Wood also speaks of seeing hot discharge pipes from air cylinder. We have been handling from thirty-five to fifty car trains for the past five years, and have not seen that yet, but we don't pull leaky trains further than yard limits, and after we delay train once or twice to fix a leak, the air inspector will be more careful. Your ideas about running pumps are right; give them time, keep oil out of air cylinders, and they will never get hot if receiving valves have ⅜ and discharge valves ⅛-inch lift (8-inch pump). In regard to stopping the brake valve handle in running position by putting in a stud, don't ever do it Will, as you will surely get left if you ever want to release in a hurry or recharge on a mountain grade. If there was a plug needed the Westinghouse people would have put it in, sure. I could state a dozen reasons why not, but must come to an emergency stop for the caller.

Missoula, Mont. L. D. SCHAFFNER.

Another Welding Tool Steel Flux—Twenty Years Old.

Editors:

In your August issue there appeared an article on "Welding Cast Steel," also a photograph of a lathe tool. This recalls some experiments made by our smith shop foreman some twenty years ago, when he succeeded in welding several pieces of steel together by means of a flux. He made several lathe tools this way, and he also made a razor from steel welded in this manner, and those that had the privilege of being shaved by this razor pronounced it a very good one. One of these lathe tools in a single cut reduced the diameter of an iron axle 1¼ inches, and they were considered as good as any other tools made from tool steel for machine work at that time.

Nothing more was done with them, and the matter was entirely forgotten until this article appeared. We have resurrected one of them from among a lot of curiosities that we have. This one was drawn down 1 x ¼ inch. The end shows portions of two old files, three nut taps and a piece of a broken die. Our flux was also homemade, and was simply the slag from the heating furnace pulverized.

Kingston, Pa. FRED ALLOMPEL.

[The specimen sent was a twin brother of the one we illustrated, or, perhaps, its father, as it was twenty years older.]

Brake-Cylinder Pressure Graduating and Maintaining Triple Valve—Its Virtues and Its Faults.

Editors:

I herewith inclose a blue print, which is a sectional elevation of a brake-cylinder pressure graduating and maintaining triple valve. The invention consists in an improved triple valve, in which the new features are additional to those of the ordinary quick-action Westinghouse valve, so that they can be readily incorporated in existing systems.

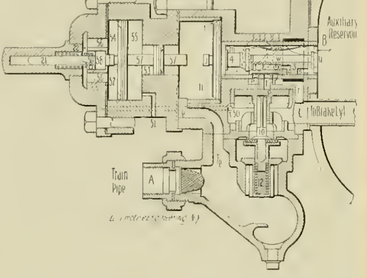
By this improvement the valve will do everything that the present valve will do, and, in addition, six other desirable features are introduced not possible with the valves as now constructed.

1. It will stop a train quicker, because of a practically constant auxiliary reservoir pressure, thereby getting a quicker equalization between the auxiliary reservoir and brake cylinder, and as every car throughout the whole train will have the same pressure on brake pistons.

2. When the brakes have been set they cannot leak off.

3. It will do away with the "pressure-retaining valves," and place the braking of the train in the hands of the engineer altogether.

4. Every car throughout the whole train will have the same pressure on brake pistons, irrespective of the piston travel than the latter, and each moving in a cylindrical chamber 54, 55.



5. The engineer cannot "lose his air" by the injudicious applications of his brakes.

6. The engineer will have better control of his brakes, for if he should consider that he had set them too hard, he can charge his train pipe with any additional pressure and get brake service according, and not have to "knock them off" and then reset them.

The equipment of a train and the action of this valve in service is as follows:

The auxiliary reservoir *B* is preferably made considerably larger than is now the custom, so as to give a greater body of air to draw on, or in lieu of this, a second train pipe (not shown) may be provided, connected directly with the auxiliary reservoir through a suitable check valve, and connecting to the engineer's brake and equalizing discharge valve through the feed valve when the handle of valve is in service application and on lap, in order to keep up the pressure in auxiliary reservoir.

The train pipe *A*, passage *e*, chamber *h*, piston and rod 4, knob *j*, port *i*, slide valve 3, valve 7, ports *s*, *w*, *z*, *n*, *t*, *r*, *k*, chamber and passage *C* and the pistons and valves of the quick-action movement are all those usually found in the Westinghouse quick-action triple valves, and need not be described at length. The ports are shown in the position they occupy when the brakes are released, the train pipe being in communication with the auxiliary reservoir through the port *i*.

In carrying out my improvements, I arrange in line with the knob *j* and rod 4, a stem 57, on which are secured two pistons 52, 53, the former considerably larger

The smaller chamber 55 forms a passage between chamber 54 and chamber *h*, and the space between the pistons 52 and 53 communicates with the atmosphere, as by port 51. In line with the stem 57 is the graduating stem, or plunger 21, sliding in its socket, and pressed outward therefrom by the helical spring 22. On its end it carries a piston valve 58, sliding in a cylinder, as shown, which communicates with chamber 54 by ports 50. A port (50) runs from the chamber and passage *C* to the cylinder of piston valve 58, into which it opens behind the piston 58, when the latter stands in its normal position, as shown.

The stem 57 normally abuts against the plunger 21, so that when a service stop is made, the travel of piston and rod 4 is arrested, as usual, by the knob *j* striking the end of stem.

When the ports stand as shown in the drawing, the train pipe *A*, chamber *h*, and auxiliary reservoir are charged to the normal pressure of seventy pounds. There is no pressure in the chamber 54, and the stem 57 is kept pressed against the stem 21 by the pressure on the small piston 53. Upon reducing the pressure in the train pipe, as usual to set the brake, the piston and rod 4 moves to the left until the knob *j* strikes the stem 57, allowing the air in the auxiliary reservoir to pass into the brake cylinder by way of passage *r* and chamber and passage *C*. The pressure also passes through port 50 into cylinder of piston valve 58 and chamber 54, and when it has reached a point high enough to enable the large piston 52 to move the stem 57 against the still higher pressure on the small piston 53, the stem will be forced to the right, carrying before it the piston and rod 4, and positively seating the graduating valve 7—a result that does not occur in the usual triple valve until the pressure in auxiliary reservoir has equalized to that in the train pipe.

With my invention, the valve 7 is positively closed as soon as the pressure on piston 52 and on one side of piston 4 overcomes that on piston 53 and the other side of piston 4.

Now, if there should be a leak in the brake cylinder or its connections, the pressure on the large piston 52 will be reduced, because chamber 54 is in communication with the brake cylinder by port 50. The pressure remaining in the auxiliary reservoir would then, acting upon the piston 4, move all the pistons to the left, positively opening valve 7 and again renewing the pressure in the brake cylinder. This action of the valve will continue automatically so long as the pressure in the train pipe and chamber *h* is kept below that in the auxiliary reservoir.

It will be noticed that the pressure in the brake cylinder depends not upon the amount of reduction of train-pipe pressure, but upon the proportions of the pistons 4, 53, 52. As the diameter of freight triple-valve piston 4 as at present is 3¼ inches, the diameter of piston 53 be made 1⅛ inches, and the diameter of piston 52 be made 2⅞ inches, then the pressure in the brake cylinder for every reduction in the train-pipe pressure will be as follows

Auxiliary Reservoir	Train Pipe	Brake Cylinder
70	70	0
70	65	21.8
70	60	30.3
70	50	47
70	40	60
70	36	70

It will then be seen that a gradual reduction of thirty-four pounds in the train-pipe pressure will set the brakes with the full auxiliary reservoir pressure on the brake piston.

To set the brakes at once with the full auxiliary reservoir pressure, as in cases of emergency, a sudden reduction of ten or twelve pounds is made in the train-pipe pressure, causing the auxiliary reservoir pressure to force the piston and rod 4, the stem 57 and plunger 21 as far as they will go to the left. This movement of the pistons and stems brings into play the quick-action parts of the valve, admitting the train-pipe pressure directly into the brake cylinder in the usual manner. The piston valve 58 closes the port 50, preventing the pressure in the brake cylinder from having access to the large piston 52, and thus rendering inoperative the automatic action of the pistons, which occurs when a slight reduction of train-pipe pressure is made, as fully described above.

It will thus be seen that I enable the engineer to keep the brakes set a constant pressure during a long period, as when running down a long grade, without the use of "pressure-retaining valves" and without any danger of "losing his air", while the usual operation of the quick action parts of the triple valve is not in any way interfered with. It will also be seen that since the brake-cylinder pressure bears a fixed ratio to the train-pipe pressure and is governed solely by the relative sizes of the pistons, the pressure in all the brake cylinders on the train will be the same, irrespective of the travel of the brake pistons. This gives a uniform braking effect on all the cars, which is a great advantage. With the system in common use, the pressure in the brake cylinder varies with the travel of the brake piston—being greater on the piston which has the shortest travel.

It will be seen that cars equipped with these valves will work in harmony with cars equipped with the present valves, and that where passenger cars are already equipped with the Frost Dry Carburetted system of lighting, these valves can be advantageously attached directly to that air reservoir, thereby doing away with the trouble experienced now, when the check valve from train pipe to air reservoir leaks.

Although, when first charging up a train with large auxiliary reservoirs as suggested, would require a greater volume of air than at present, yet when once charged up and in actual service, the amount of air required will not be any greater than now, and the main reservoir volume on engine for controlling brakes, need not be very much greater than at present either.

J. A. STEININGER.

Creston, Ia.

[We have published the above communication from Mr. Steininger, with a cut of his device, as it is an excellent illustration of a class of communications which we are constantly receiving.

Mr. Steininger has evidently given a good deal of study and thought to the matter which he presents, having certain apparently desirable objects in view and displaying a good deal of ingenuity in attaining them. The great difficulty with inventions of this kind, is the lack of proper consideration of certain indispensable features in the improvement of the air brake and similar apparatus used upon railroads and we have thought it would be a good plan to publish this communication and point out some of these features for the benefit of others who are giving a good deal of their time to matters of this kind upon a basis which is wholly impracticable.

The indispensable feature of Mr. Steininger's invention is that two lines of train pipe must be used, or a very much larger auxiliary reservoir than that now used in connection with the air brake. It has long been known that a great many things, some of which would be desirable, could be accomplished if two lines of train pipe could be used. Long ago, two such lines of train pipe were used, and it was one of the improvements which made the air brake generally acceptable to the railroads when one of the lines of pipe was discarded, and the automatic operation of the brakes became possible with one line of pipe. While it is known, therefore, that some advantages would result from the use of two lines of pipe, it is generally regarded by railroad men that these advantages would be more than offset by the disadvantage of the additional apparatus, and so long as a brake operated by a single line of pipe will meet all the requirements of service in this country, with reasonably good judgment in handling by the engineer, there is no possible field for a brake with two lines of pipe. There is only one thing left to do in order to use Mr. Steininger's improvement, which is to use a larger auxiliary reservoir.

It is well known that, if a quantity of compressed air is drawn off from the reservoir containing it, the pressure in the reservoir is reduced. If the pressure is to be reduced only *slightly*, by drawing off the given quantity of air, the reservoir must be so large that the quantity of air drawn off is very small in comparison with the volume of the reservoir. In order to carry out Mr. Steininger's plan, therefore, it would be necessary to have a very large auxiliary reservoir. Without stopping to point out that, on a large proportion of the freight car equipment now in use, such as hopper-bottom gondolas, it would be impossible to find room for a larger reservoir than is now used, we want to indicate what difficulties would be encountered if the plan were carried out.

In the first place, the system proposed by Mr. Steininger would not work harmoniously with that now in use. A certain reduction of the train pipe pressure would apply the brakes now in use harder than it would those of Mr. Steininger's system. A 20-pound train pipe reduction would *fully* apply the brakes of the cars now in service, while Mr. Steininger's brakes would be applied with only about two-thirds their full force. This, as everybody who has handled air-brakes knows, would cause a very bad effect in trains where the two brakes are mixed, causing trains to break in two, etc. It would therefore be necessary, if Mr. Steininger's system were adopted, to change the brakes on the 250,000 or more freight cars now in use. This would require first, that the present reservoirs be removed and very much larger ones be substituted for them; then, as a full application of the brakes would give a higher pressure in the brake cylinder than is now obtained, it would be necessary to change the levers on all these cars so that the pressure of the brake-shoes on the wheels would not be any greater with the higher cylinder pressure than it is now. It is wild to think for a moment that the railroads would put into use upon their cars any kind of brake apparatus which would not work harmoniously at least for service applications, with what they now have in service. Any improvement in the brake apparatus must be such that its advantages can be obtained upon cars equipped with it, while in all other respects the brakes must work in harmony with those now in use.

There is another serious objection to this system. As a higher cylinder pressure than is now employed would be used to do the same work, more air would have to be compressed by the pump for each application. Also, as a greater reduction of pressure in the train pipe would be required to operate the brakes than is now the case, a greater quantity of air would be wasted from the train pipe at each application. On long trains this would be very serious. From both these causes, therefore, a considerably greater service of the pump would be required. It would also take a longer time to charge up a long train, which would oftentimes cause delays, and, although the auxiliary reservoir pressure would be reduced only a little with each application, it would take a longer time to recharge to 70 pounds again. On this account, where an engineer made bad use of his air by frequent applications, he would get his pressure reduced and would hardly, at any time, have time enough to get the apparatus recharged, so that he would have poor brakes all the time.

Another defective feature of such a system would be the greater difficulty in releasing brakes. The brakes are released only by the difference of the pressures in the train pipe and the auxiliary reservoir. The higher the pressure in the auxiliary reservoir, after the brakes are applied, the higher the pressure must be in the train pipe in order to release them, and it will be necessary to carry much larger main reservoirs on the engine, or a considerably higher excess pressure, than is now the custom, in order to release the brakes on a long train. The hardest problem in air brake construction is to secure a prompt and sure release of the brakes and any device or scheme which renders this particular problem more difficult is an objectionable one.

Beside the fact that Mr. Steininger adds two pistons and an extra valve to the apparatus now in use, as well as a much larger auxiliary reservoir, making it considerably more costly, there is one defect in construction which is so often overlooked by men working on the air brake that we want to point it out. It has long been known that it is practically impossible to keep a small piston tight against air pressure. The small piston 53 is the only means of preventing the air in the train pipe from passing directly to the atmosphere through the port 51. As it may as well be set down as a fact that the piston 53 cannot be kept tight, it is evident that there will be a constant leakage of air from the train-pipe to the atmosphere by the piston 53 and through the port 51, whether the brakes are on or off. The accumulated leakages of this kind on a long train would, in all probability, prevent charging up the large auxiliary reservoirs to the proper pressure, and, when the brakes are once partially applied, the leakage of the air from the train pipe would soon cause them to be fully applied, which, in descending long, heavy grades, would practically result in the engineer's losing control of his train. Such leakage would also very seriously interfere with the release of the brakes. It is astonishing how easily and generously piston valves of this kind are thrown into designs for air brake apparatus by persons who have not had the right kind of experience. There is no place in an air brake system where the escape of air to the atmosphere must be prevented, in which a piston valve will work satisfactorily.

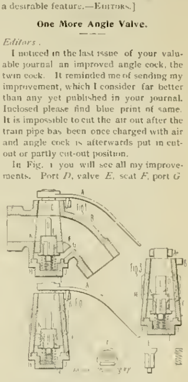
It might also be profitably considered whether the objects sought by Mr. Steininger are desirable ones. He proposes to do away with the pressure-retaining valve. It is now regarded by a good many railroad men that it would be an unfortunate thing to do away with the pressure-retaining valve. Since the pressure-retaining valve is present and has to be used, it requires that the trainmen shall have some part in the handling of brakes down heavy grades. As it is undoubtedly true that no air brake system could ever be made so perfect that accidents to it would be impossible (such as the giving out of the pump, or some similar difficulty), it is important that the trainmen should always be prepared to operate the brakes by hand, if such a difficulty, however remote it may be, should arise. The presence of the pressure-retaining valve requires the presence of the trainmen on top of the train near the brake wheels, and the time will probably never come when this will not be a desirable feature.—EDITORS.]

One More Angle Valve.

Editors:

I noticed in the last issue of your valuable journal an improved angle cock, the twin cock. It reminded me of sending my improvement, which I consider far better than any yet published in your journal. Inclosed please find blue print of same. It is impossible to cut the air out after the train pipe has been once charged with air and angle cock is afterwards put in cut-out or partly cut-out position.

In Fig. 1 you will see all my improvements. Port *D*, valve *E*, seat *F*, port *G*



stop *M* and spring *I*, also cock in cut-in position.

Fig. 2 shows cock in cut out position, showing port *D* in communication with train-pipe pressure, also shows valve *E* open, allowing air to pass through port *D* to main portway *L*, down through opening in seat *F* to space below plug valve *C*, out through port *G* to space back of cock in cut-out position, allowing engineer to control his brakes by air on entire train, if angle cock is cut out after train pipe has once been charged with air.

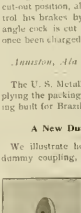
W. R. HOWSON.

Anniston, Ala

The U. S. Metallic Packing Co. are supplying the packings for all the engines being built for Brazil.

A New Dummy Coupling.

We illustrate herewith a new form of dummy coupling, recently designed and patented by Mr. J. A. Jessom, air brake inspector of the L. & N. Railway, at Nashville, Tenn.

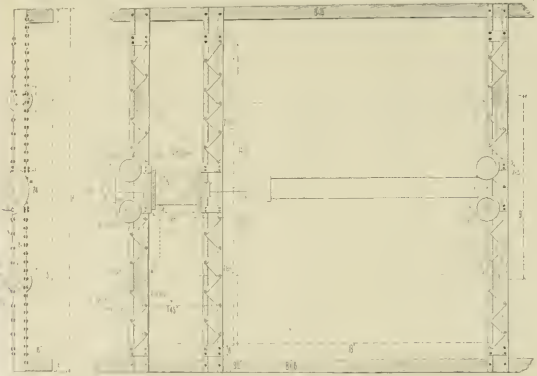


It is a simple, single malleable casting. In coupling, the teat is inserted in the opening of the hose head and the piece turned so that the lugs engage the jaws of the coupling.

The teat slightly compresses the rubber gasket, keeps it in place and makes a dust-tight joint, without friction on the face of gasket. One of the best advantages of the device is that the hose cannot be hung up without closing the opening in the hose. There is no hook to cause half a job and ruin the gasket.

Pneumatic Tank Lift, M., K. & T. Ry.

The accompanying illustrations show the plan adopted to lift tanks off tender frames when it becomes necessary to inspect or repair either of them. The plan adopted to make one piston handle four ropes evenly is a simple and efficient one. About all there is to the device is the cylinder, pulleys and ropes, the timbers of



the building being used as a frame. Jacks with tall frames are used to lower the tank upon, to take to other parts of the shop, and hold it at convenient height for making repairs to the bottom, where such are needed.

This is another of those handy time-savers gotten up by Mr. C. T. McElvaney, M. M. of the M., K. & T. shops, at Denison, Texas.

Mechanical Organization of Southern Railway.

A general order has been issued by Vice-President Baldwin, of the Southern Railway, as follows:

"The jurisdiction of R. D. Wade, superintendent of motive power, is hereby extended to include the Western system.

"He will be assisted by an assistant superintendent of motive power, with office at Washington, D. C.

"The assistant superintendent of motive power and master mechanics will report to and receive their instruction from the superintendent of motive power. Road foremen of engines and engineers and firemen will be under the control and supervision of the superintendent of motive power and will report to him through the master mechanics in all matters relative to the condition of locomotives; but in all matters pertaining to the discipline while on the road they will be under the direction and control of the superintendents, who will have full authority to suspend or discharge engineers or firemen. Engineers and firemen will be appointed by the superintendent of motive power, through his assistants, but no engineer or fireman shall be appointed until he has passed an examination on the rules and regulations by the superintendent or his representative, and received a certificate of competency from him.

"The superintendent of motive power will have general supervision of all machinery, shops, engine houses, car-sheds and all employés engaged in the work of constructing, renewing, or repairing rolling stock.

"The superintendent of motive power will assign engines to the different divisions, and change such assignment from time to time as may be necessary.

"He will prepare and issue plans for standard locomotives and cars of different classes and standards for all details for repairs, which must be strictly adhered to.

"The superintendent of motive power will report to the third vice-president."

To Enginemen Desiring to Go to South America.

We have received numerous letters from engineers and other classes of railroad employés asking for information in regard to securing employment in Brazil.

These inquiries are no doubt brought about from the fact that a large order for locomotives for that country has been placed with the Brooks Locomotive Works, of Dunkirk, N. Y.

We have taken some pains to inquire into this matter, and from a railroad man recently returned from Brazil we learn that there are no vacancies in that country but what can be filled by native Brazilians, and the rate of pay would be no inducement for a railroad man from this country to seek employment in Brazil.

The locomotives mentioned above are not intended for a new road, they are merely to replace those on existing roads worn out in service.

Tool Dresser Lore.

We cull the following items of advice to tool dressers, from that splendid little house organ of the Crescent Steel Co., *Sparks from the Crescent Anvil*:

One purpose is mighty apt to win,
Quit hardening steel at the forging heat.

There is nothing better to quench in than water.

Do not lay hot steel in a draft, or where it will cool unevenly.

A drill hardened on an ascending refining heat will cut twice as much as one that is slightly overheated.

Anneal in charcoal dust, putting sawdust next the steel, and it will come out soft and work like decarbonized steel.

Where high steel has been put improperly into shapes liable to crack, try a bath of warm, muddy water, if oil is not at hand.

In annealing steel, care should be taken to get it hot through, and then it should not be soaked in the fire long enough to raise a harsh scale.

Watch the hardening heat, for this is where the value of a tool is fixed. If heated too high no drawing down will ever restore the original strength of the steel.

Do not forget that if a tool is overheated for hardening it is vastly better to let it go cold and then reheat, than to let it cool down and then plunge on a descending heat.

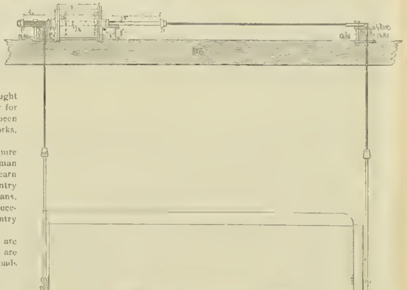
The blast pressure in heating steel in moderately heavy work should not exceed one-quarter pound per square inch of air column. A good body of fuel should be placed between tuyere and piece operated upon.

No hardened piece is as strong as the tempered piece, a slight tempering, say to dark straw or very light brown, gives great increase of strength, a much tougher edge and so little decrease in hardness that the difference is not noticeable.

Although the coarser grain obtained by overheating is really a little harder than the fine grain obtained by dipping at the refining heat, yet this fine grain is so much stronger that it will do from fifty to one hundred per cent. more work.

If, in hardening delicate tools, a portion of the tool is only black hot while other portions are red hot, the tool would be more certain to crack from the uneven heat than it would from the same unevenness where the lowest heat was red and the highest a little hotter. But both conditions should be avoided.

We have received from the Richmond Locomotive and Machine Works a pamphlet describing their two-cylinder compound locomotive. The book shows photo reproductions of the engines, illustrates and describes their intercepting-valve gear and gives dimensions of the engines and copies of the performance sheets of the roads using them. In the announcement they say: "In presenting our compound locomotive, we think it proper to state that, in view of the many objections that have heretofore embarrassed the general adoption of the compound locomotive, we have hesitated in offering our arrangement until it should have been demonstrated by actual service that it would fill the requirements in every respect. To this end we have left the management of the engines entirely to the railroads and their regular crews, without any trained assistance from us, with a confidence that is shown not to have been misplaced, in the efficiency, simplicity and durability of our valve mechanism. Thus we have the testimony from the railroads themselves, as shown on the accompanying performance sheets, that establish beyond question the superiority of our device at every point over simple engines of the same build, age, type and carrying the same boiler pressure, in economy of fuel and maintenance, and at the same time hauling full trains on schedule time." Any one interested can, we suppose, secure a copy of this pamphlet by addressing the works at Richmond, Va.



We have been shown some very nice castings of "Johnwhit" metal (principally aluminum) for frames and other parts of model locomotives, made by Mr. Geo. H. Olney, of Brooklyn. Mr. Olney has taken New York Central Express Engine "897" as his standard and made his parts to scale from her measurement. Anyone making a model locomotive can get these parts, either finished or in the rough, very much cheaper than they can be made. Some 150 patterns are in use and any part can be had.

Hammer Dies for Making Car Links.

The ingenious hammer dies shown herewith have recently been perfected by General Foreman J. H. Ebert and Foreman Blacksmith Jos Smith, of the Interoceanic shops, at Puebla, Mexico.

Fig. 1 is the upper, and Fig. 2 the lower die.

Fig. 3 shows how the lug L^1 on the upper die binds the link into the recess of the lower one.

Fig. 4 shows the recesses in dies for scarfing the ends to be welded. These recesses are also shown at K^2 in Fig. 2.

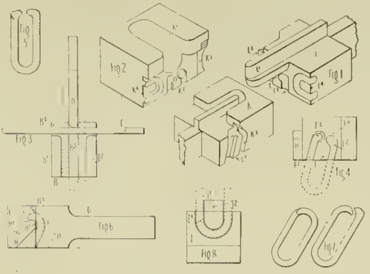
Fig. 5 shows the link scarfed, and Fig. shows the bending die at end of hammer, also shown at L^2 Fig. K. Fig. 7 shows one side of the link after being bent, also after both ends are bent.

Fig. 8 shows the welding recess of the dies and it is also shown at K^4 in Fig 2, and L^1 in Fig. 1.

Thus this single set of hammer, die and block will complete a link without taking any material away from it.

In practice they form the link complete at one heat except the welding, which is the final operation, the material being reheated.

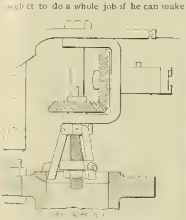
With a small furnace this arrangement will turn out lots of work, and the links made on it are exactly uniform and the welding perfect.



HAMMER DIES FOR FORMING LINKS.

Simple Machine for Grinding Steam Pipe Joints.

The hard drudgery of the dirty job of grinding in steam pipe joints is so repulsive to the ordinary mechanic that he will neglect to do a whole job if he can make



a joint hold steam until the engine gets out of the house

Mr. William H Hill, of the U P shops at Denver, Col., has recently patented a simple device for doing this kind of work that deserves mention.

The construction is made quite plain in the detail drawing, which shows the machine set for work on a steam pipe joint. The ring is held by three wings that are forced tight on the inside by the lower nut, which expands them, a steel plug on the outside of each wing keeping the ring from slipping up. The upper ends of the wings, or chuck jaws, are hinged in the collar under the U frame. By having the stud and lever bolts loose considerable side and cross motion can be given to the ring, and the pressure is regulated by the hand lever.

Our second engraving shows the tool set on a T-pipe, or "nigger head," a hard place to get at.

It is driven by a flexible shaft and speeded up to over 300 revolutions per minute.

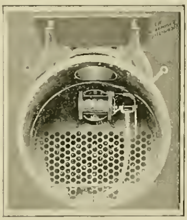
It is easy to turn the machine over to examine the ring, just as is done with the wooden plug when grinding by hand.

At the U P. shops, in Denver, they use this device to grind in steam pipe joints, while the pipes are lying on the floor.

The tendency of hand work is to let it go when a thin joint shows good contact all around, with the machine there is always time and inclination to make a good job of fit the entire width of ring.

An Instructive Shop Mate.

It is strange to reflect on the quality of the human instruments that are sometimes employed to exert supreme influence over our lives. My boyhood, and probably most of my life, has been greatly influenced by the training, direct and indirect, given by a working boilermaker named William Laurie Willie was not of the clay heroes are generally molded from, but for a time he was a good deal of a hero to me He had the reputation of being the best boilermaker on the railway system. Excellence in any art carries astonishing



elements of hero worship to the possessor from the large class that are ready to admire anything well done.

Shortly after entering the shops I was assigned to Willie Laurie as his assistant, my principal duties being to carry his kit of tools and hold the torch while he was doctoring the inwards of decayed boilers and fireboxes. William's tastes and propensities may be inferred from a conversation I heard the day after I became his principal assistant, and which still sticks to my memory, while so many more useful things have evaporated under the touch of time.

While a group of workmen were lounging on a tender frame waiting for the starting bell to ring, the attractive theme of what each liked best to drink came up for discussion. Numerous views were expressed and preferences given. Some liked a mixture of ale and porter, others liked various mixtures of beer, whiskey and all the thirst-killing pharmacopœia seemed to be named, when Willie, as a veteran, was appealed to for an expression of his preference. "Weel, lads," he replied, "I don't know anything better than a glass of whiskey mixed with another glass of whiskey "

But for his whiskey loving propensities I suppose Laurie would have risen above the grade of workman, for he appeared to have a knowledge of boilers rarely found among any officials at that time.

He exerted a great influence on me through a habit he had of asking questions framed to puzzle and embarrass a boy. Two or three days after I went with him he put me out by the question, How long are the grate bars of No. 9?

I did not know, and he informed me that a turnip head that did not know the length of bars he had sat on for two hours would never make a boilermaker. Then he made me guess the size, and laughed at the length I was off.

The next firebox we went into I measured the length of the fire bars on the sly, and after we went out he asked me the distance from the fire bars to the crown sheet. He had a mocking tongue, and I never enjoyed being called a blockhead. As there appeared to be no end of the things he would ask questions about, I began to prepare myself that I might escape ridicule. One day it would be the number of stays on the side of a firebox, another day it would be the thickness of sheets or the number of rivets in a seam and their size.

When I was not otherwise engaged I used to go into fireboxes and boilers to study details so that I would be ready with answers to Laurie's questions. This developed habits of observation which proved very useful in after life.

Laurie was a man who had intense admiration for skill and knowledge of boiler-making business, and a man possessing these had all other faults or sins readily forgiven. He appeared to have very little knowledge of anything else, but the designing, building and repairing of boilers he knew to perfection.

The workmen had a joke at Laurie's expense. Although he loved the flowing bowl not wisely but too well, he was like most of his countrymen, a God-fearing man, and a member of the kirk. It happened that his better half brought a son into the world, and on application being made for the baptism of the bairn, William was invited to a private interview with the minister.

The latter, an austere man, whom I remember for his strong denunciations of Popery, and his graphic pictures of the brimstone regions, where he said most of us were destined to spend our future. This shepherd took William to task about his moral condition, and within a few minutes, with upturned eyes, exclaimed

"Willie Laurie, ye're not fit (able) to hold up an infant for the Lord's baptism "

"No fit tae haud up the bairn?" replied Laurie hotly, "I could haud it up if he was as heavy as a firebox."—*From lecture at Sibley College by Angus Sinclair.*

Thomas' Pneumatic Flue Cleaner.

Mr C. F. Thomas, M M. of the R. & D. shops, at Alexandria, Va, has recently patented a device in use some time at his shops for cleaning out locomotive tubes.

He uses compressed air alone, without the use of flue auger, and removes the cinders from the stopped flue to the front end by using a clear flue as a conveyor.

Fig. 1. shows the complete device in place ready to use.

Fig. 2 shows the details

In Figs. 1 and 2 the part marked 29 is simply a plug which is shoved into any convenient flue, and to which is attached the hose head for coupling onto the shop supply of air, and carrying the air valve 27 and the small hose connection.

The central device in Fig. 2 is merely a wedge operated by a lever to fasten the whole apparatus to the flue sheet firmly, 2 is a pipe for conveying cinders to the clean flue, and 8 a rubber washer to prevent their being blown out into the firebox.

The part marked 22 is a rubber diaphragm through which the small hose is shoved into the tube. This piece also has a rubber ring to prevent cinders from escaping.

When the device is shoved into two flues, one stopped, the other clear, the lever in the center locks the device against the flue sheet and a second lever operates eccentric 10 in such a way as to force the two rubber rings 8 and 8 against the flue beads.

Air is turned on, and the jet dislodges the cinders and sends them through the hollow tube frame to the front end As the cinders are removed, the operator shoves the small hose into the tube, keeping it well up to the obstruction.

This device can be used behind a brick arch without disturbing it at all, and is so neat and handy, being small, that it is bound to come into use where flues must be cleaned—and where do they not?

At present, to use an auger either the arch must be removed—which means a new one nine times in ten or the front end arrangements must all be disturbed, and it has been the rule to bear with the loss of a lot of effective heating surface rather than go to the expense of new arch or taking out draft pipe, diaphragm or nozzle stand.

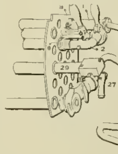


Fig. 1.

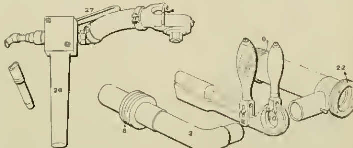


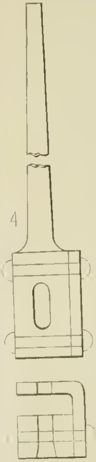
Fig. 2

Some More Blacksmith Shop Kinks.

Continuing the subject of small tools and handy rigs for blacksmith's work, we show herewith

SPRING LEAF SLOTTER GUIDE.

The Fig. marked 4 is in use on the C., H. & D. for slotting hangers and spring leaves. Its construction and use will be perfectly plain to any blacksmith; it holds the work and the punch securely, and admits of doing the job on a steam hammer.



EYE BOLT FORMER.

Fig. 6 is a device for bending [illegible]-inch eye-bolts, brake beam hangers, etc. As shown, levers A and B are in position to receive the iron, then lever A is brought to pin C; this makes the first bend and prevents the work from slipping forward when lever B is brought around to the right, thus forming the eye complete; e is a roller, f stop pin, g slot in lever A to hold iron in place.

Eye bolts or brake beam hangers with an eye on one or both ends are expensive things to make by hand; by cutting up the stock the

FIG. 6.

right length and using this tool uniform work can be turned out very fast.

These tools were designed by Foreman Blacksmith A. L. Woodworth.

HAMMER DIE FOR PUNCHING KEY WAYS IN DRAFT BOLTS.

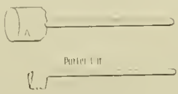
This is a simple die plainly shown; it is in use on the B. & O. Southwestern, designed by Foreman Blacksmith J. A. Mick.

This cut hardly needs an explanation. The upper die shown is the lower one on the hammer; the upper one is kept in proper alignment by dowel pins, as shown, and a fork with handle, shown at bottom of cut, is used to handle the top die. The punch is made short enough so that the hammer will strike the dies instead of the punch after the work is done.

On the right is shown a form of draft-bolt they make that requires two punchings. They also punch holes in spring hangers with a similar rig.

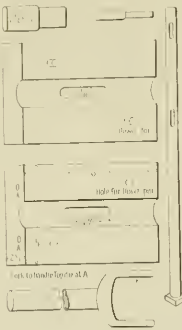
IMPROVED PORTER BAR.

At these shops they make their own axles, etc., from scrap, and to save welding a porter bar on to an axle or wrought chunk of iron from furnace, they make a bar scarfed as shown, place the hot iron under the hammer and drive the bar into the edge of it as shown; this holds all right and is not hard to get out.



PUNCHING OUT SWITCH RODS AND ECCENTRIC BLADES.

Harry Jefferys, foreman blacksmith at the Pittsburgh Locomotive Works, has done lots of railroad work, and shows how

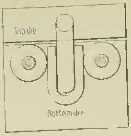


to do some things by punching that, as a rule, are done in some other way. For instance, he shows in the accompanying sketch how to punch out switch rods and tie bars that are usually welded up. To do this he uses three punches, first to make a square hole in the bar, next to enlarge this hole to proper shape to receive base of rail, and then to reduce body of rod back of head, leaving a fillet from which the iron is sheared down.

He uses the same method to form the fork of eccentric blades from a square bar of iron, as shown in the next sketch.

His dies are cast iron and without finish, used as they come from the foundry. He leaves plenty of room in the solid die block, and uses a loose wedge to keep the hot iron in place and prevent its "squashing out."

He also shows a method of bending heavy links by putting two rollers on the side of the lower die, and using a lip on upper die of the proper shape.

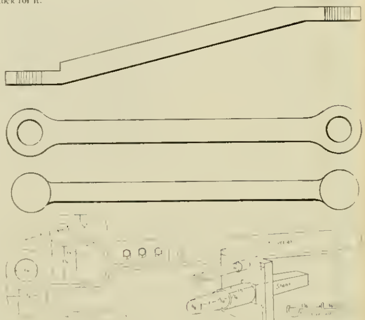


MAKING BOSSES ON BRACES OR LADDER RUNGS IN A BOLT MACHINE.

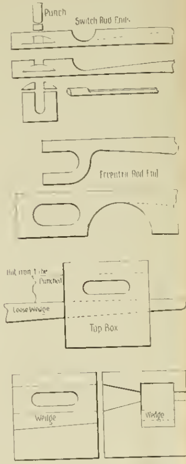
John Cotteral, foreman blacksmith of the D. & R. G. road at Grand Junction, Col., had lots of small braces, such as shown in lower figure, to make. He conceived the idea of using his bolt header for the purpose. He accordingly countersunk the heading dies of the machine and concaved the plunger end; this made a ball on each end of the rod; the blacksmith flattened the ball under a hammer and punched it, and the set was given at the same heat.

This blacksmith makes ladder rungs for cars in the same way.

The same man uses a hand bending device, shown herewith, for making the eyes and bends in the standard brake hangers of the road. The eye in the end of the tool is slipped over the large post in the block shown, the shank of which is held in the anvil; the steel stud serves as a guide, and the roller in the tool does the bending. The gauge shown is the form used for measuring and testing the work done by the tool and in cutting up the stock for it.



The articles on "Coppersmithing for Railroad Shops," will be concluded with the next issue of the paper.



All railroad men know that one of the desirable things in life—railroad life—is to reduce the dead weight of trains in proportion to the load hauled. Those who are sudying this problem may be interested to know that Supt. of M. P. Mitchell, of the Erie, has been experimenting in this line with results. He took all cast iron parts off a 60,000 pound car, and substituted malleable iron of equal strength, saving in weight 1,100 pounds. On some heavy, double hopper-bottom cars a saving of 1,300 pounds per car was made.

Judge Swan, of the United States Circuit Court at Detroit, in a decision rendered August 21st, denied the motion for a rehearing in the Cody patent case, thereby affirming a previous decision of the same court in favor of the Consolidated Car Heating Company of Albany, N. Y.

Last year the Peerless Rubber Co. put out, on the quiet, some steam-heating hose made on a new plan—that of using pure Para rubber, without wires or mineral substances. The result of trying what the best pure rubber hose would do, instead of inventing a steam proof mixture, was something new, and was found to be something better than known. They now guarantee this steam hose for one year, with 80 per cent. of it lasting two years.

The Traveling Engineers' Association have just completed a very successful meeting—their second annual—at Denver. We shall publish a synopsis of the paper in the next issue of this paper.

The Union Railroad, of Providence, R. I., have ordered the Consolidated Car Heating Co.'s electric heaters for their 200 street cars.

*Railroad Coppersmithing—XI.

By John Fuller, Sr.

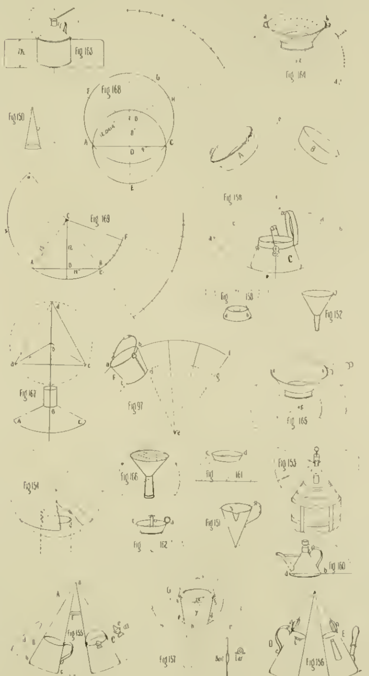
PATTERNS FOR CONICAL WORK.

In many railroad shops the tinmen and coppersmiths are huddled together under one roof, or under the direction of one foreman, and all kinds of sheet metal jobs find their way there, and are expected to be done by the men engaged or working in these branches. Perhaps some one of the tinmen can do an occasional copper job, or a coppersmith must do some stray job of tin or sheet iron work, as hinted in Chapter VII. In these shops there is often work to be done which requires a knowledge of cones or their envelopes. When I was a boy the questions involved in cones greatly puzzled me, as it has many before who, like me, were in the unfortunate position of having no opportunity of gaining an education except that wrung from the exigency of surrounding circumstances and the school of stern experience. There were no books or papers of a practical nature on these subjects within my reach, and a boy must make friends of the men with whom his lot is cast or work out his own destiny by himself. I tried both expedients.

Perhaps it will interest my boy readers to tell of my first lessons in the direction of conical work, and show their application in a few articles in every-day use furnishing as they do stepping stones to further search in the mysterious but interesting science of sheet metal working, or more properly, practical geometry. My first lessons in the direction of cones was making common extinguishers and bedroom candlesticks.

These two articles were of much interest to me, an anxious boy, right at the very threshold of the sheet metal trade. After I had been working some two or three years, diligently investigating all the problems that came in my way, I found out that the old workmen had or used five primary fashions or standards in cones by which they designated their work, so that they might understand what they were talking about when discussing or giving directions in the various kinds of conical work in which they might be engaged. These primary fashions were named and understood as follows, namely, extinguisher, muller, funnel, lantern-head and hood, and are illustrated in Figs. 150, 151, 152, 153 and 154. The envelope of the extinguisher, Fig. 150, it will be seen, is formed of one-sixth of a circle, or sixty degrees, and, when turned, forms at the apex an angle of twenty degrees, that is near enough for ordinary practice. The muller, Fig. 151, is formed of two-sixths of a circle or one hundred and twenty degrees, which, when turned, forms at the apex an angle of forty, nearly. The funnel, Fig. 152, requires three-sixths, or one hundred and eighty degrees, and makes, when turned, an angle of sixty at the apex. The lantern-head, Fig. 153, takes four-sixths, or two hundred and forty degrees, and forms an angle of about eighty when turned, while the hood, Fig. 154, takes five-sixths, or three hundred degrees, making an angle of one hundred and ten at its apex, approximately. Within these five standard fashions once lay all the principal varieties of conical shapes used by the old workmen in sheet metal working requiring flaring sides. To explain First, in *A*, Fig. 155, is represented the pattern of an extinguisher once used to put out the light of a candle. This first primary fashion gave the initial lesson in pattern cutting, and was an excellent boy's job.

We were once kept pretty busy in their manufacture. The writer made many a gross, and they afforded a good preparatory lesson in the art of turning by hand, as well as wiring and laying edges true and even, fit for soldering. To get the dimensions of this pattern we multiply the base by three; this gives the radius of the circle of which the pattern is a part. Thus suppose an extinguisher *A* Fig. 155, or cone for any similar article, is required an inch and a half in diameter at the base *f*, then $1.5\times3=4.5$, and one sixth of a circle whose radius is four and one-half inches will make our extinguisher, without anything allowed for wire or lap, the tin coming together edge to edge. Next, in the same figure, *B* is an old-fashioned quart cup. This cup is made, as will be seen, extinguisher fashion, and the radius of the pattern is obtained in the



same way, namely, by multiplying the diameter of the bottom of the cup by three, which gives the radius of the circle of which the body of the cup is a part. Now take for the length of the body one-sixth of the circumference of the circle, and for the depth of the cup one-third of the generating radius *a b*, thus suppose the bottom *b c* of the cup *B* is four inches in diameter, then $4\times3=12$, the radius *a b*, of a circle one-sixth of whose circumference will be the length and form the outer edge of our pattern for the cup *B*, and one-third of twelve, or four, will be the depth, also without edges for seam or wire. The pattern for the handle is shown in *d* beside the cup. In *C* is shown a pretty milk can, also cut in the same fashion, and is exactly like the quart cup, and the pattern it will be seen is obtained in the same manner, and one-third the radius *a b* deep. The asp and catch for the cover is shown beside the can at *C*.

These are three illustrations of this fashion with the base down, two of which are in thirds, that is a third of the generating radius as the depth of the vessel.

The next, Fig. 156 *D*, illustrates the same fashion in halves, that is, the article is made one-half the generating radius deep, *D* represents a coffee pot, with a strap handle and lip, and *E* is the same thing with a wood handle and spout. It can readily be seen that the same rule or fashion is used here, thus if a coffee pot or any similar article measures six inches at the bottom, then $6\times3=18$, the radius of the circle of which one-sixth of the circumference is taken to form the body of the coffee pot *D*, with one-half the generating radius taken for the depth. Many other illustrations could be given, but these are deemed enough to show the principle.

In Fig. 157 are illustrated two common pails, one an open milk or water pail, the other a slop pail. Here the order is reversed in the article, and the small end is made to serve for the bottom, but the law is unchanged. The bodies of both are extinguisher fashion as before, which can be seen at a glance; the depth of them in these cases being one-fourth of the radius of the circle of which their bodies are a part. This slop pail affords a good example or lesson for careful study, as it embraces three primary fashions in one article, thus, the bouge (or breast) *A* is cut lantern-head, the body *F* extinguisher, while the foot *H* is funnel fashion. Suppose now the pail, as shown in Fig. 97, is to be ten and a half inches at the brim, *A B*, then $10.5\times3=31.5$ the length of the radius *E A*, and, if *E A* be divided into four equal parts, we have here in this instance the depth of the side, or $\frac{31.5}{4}=7.875$, that is, seven and seven-eighths without edges. Now the slop pail, Fig. 157, is the same as the milk pail, hence for the body at the section *h g*, it is ten and a half, and at the foot, *c d*, three-fourths of ten and a half, or seven and seven-eighths, then, *c d*, or seven and seven-eighths, is the diameter of the inside or small end of the foot *H*, and the inner radius of a semicircle of which the foot *H* forms a part, or a hundred and eighty degrees of a circle whose radius is seven and seven-eighths will make the form of the foot funnel fashion. The foot may be any depth to suit the taste, although one-fourth the depth of the body, or two inches, has always been considered the right proportion. The bouge (or breast) at *h g*, is ten and a half inches, then $\frac{10.5\times3}{4}=7.875$, the radius *k g*, of which circle four-sixths is required to make the bouge, which is also cut one-fourth the depth of the pail wide, and hollowed in the hollowing block to give it the required curve and make it ready for the pail. From the foregoing explanation, and accompanying familiar illustrations given purposely, together with a careful examination of the hundreds of things about him, the reader may soon become acquainted with the subject presented for his investigation and guidance.

MULLER FASHION.

In Fig. 158 is shown three examples in the next or "muller fashion," which is formed of one hundred and twenty degrees, or two-sixths of the circle of which it is a part. This fashion, in an ordinary tinshop, is principally used for dishpans *A* and deep basins or pudding pans *B*, and some other articles, as the grease kettle *C*, all of which were once made by hand. When the fashion or standard shape has been determined, and we wish to make a dishpan or any similar article of a given diameter, say twelve inches, then we proceed thus $\frac{12\times3}{2}=18$, and find the radius of a circle eighteen inches, two-sixths of whose circumference will make the pan (without edges), and one-third the radius, or six inches, for the depth. It should be noticed that many other vessels of exactly the same principle are made, but the order reversed. I here present a grease kettle, which is an exact pattern of a round bait kettle for fishing, and is the same fashion as the pans but reversed, or the base of the cone turned down, the depth being one-third the generating radius as before. The pan *B* may be made any depth to suit, or as deep as required, its pattern being obtained in the same way by multiplying the diameter of brim by three and dividing the product thus obtained by two, when two-sixths of the circle, of which the quotient is the radius, will be the pattern required, as shown by *a b c d* in *C*, Fig. 158.

FUNNEL FASHION.

The funnel fashion, Fig. 152, is formed as shown, of three-sixths, or one-half of a circle, and is adapted especially to the funnel and a few pans and similar shallow flaring articles. Several applications of this fashion are here shown. Fig. 159 shows a spittoon, and the cone base is down. Fig. 160 is a lamp filler, also with the base down. Fig. 161 is a pan with the base turned up, forming the brim, and Fig. 162 is a candlestick, the pan of which was once made in pieces. To obtain this pattern we take the diameter *a b* of the bottom of Fig. 159, or the diameter *c d* of the

*Copyrighted by John Fuller, Sr., Seneca, Kan. These articles commenced in September, 1893.

brim of Fig. 161 as radius, and three-sixths of a circle whose radius is equal to the bottom or brim diameter will make the pattern required. Many other examples could be given to illustrate where this fashion can be and is used in the construction of many articles called for and made in a railroad shop where tinmen or lampmakers and coppersmiths all work together.

LANTERN-HEAD FASHION.

The lantern-head is formed of four-sixths of a circle, and was used for the tops of old-fashioned horn and mica lanterns, shown in Fig. 153, also oil bottles, Fig. 163, colanders, Fig. 164, hand-bowls, Fig. 165. To obtain this pattern we proceed thus: if it be required to make a colander, Fig. 164, twelve inches at the brim *a b*, then the rule is $\frac{12 \times 3}{4} = 9$, and four-sixths of a circle whose radius, *c d*, is nine inches will make our colander, which should be one-half the radius, or four and a half inches deep, that is, without edges for seam or wire. Hand-bowls, Fig. 165, sprinkler roses, Fig. 166, and all similar articles the same. Lantern-heads and oil-bottle tops are examples with the base down. I will here show the application of this rule to oil bottles or cans. When I made oil cans the tops were all made lantern-head fashion, and if the reader will carefully examine the best specimens that come under his notice, he will find those that please the eye the best are still constructed in accordance with this standard fashion. A top made funnel fashion never looks well because the symmetry is not in harmony with the body. Let us make a gallon oil can or bottle, Fig. 163. Now we used to make gallon oil cans from middle plates, that is, tin plates which measured 11 x 15 inches after squaring up. Take then a middle plate and cut it in two, making the pieces 7½ x 11. Notch the two ends of each piece as shown and fold them for grooving, then form them into cylinder shape by passing them through rollers, and groove down the seams, the two seams, it will be found, have taken up about three quarters of an inch, leaving twenty-one and a quarter inches in the circumference of the body. Then $\frac{21.25}{3.1416} = 6.764$, or a little over six and three-fourths inches, the diameter of our oil can body. Now burr both ends of the body a neat eighth of an inch and seam the bottom on, we are now ready for the top. Here we see the diameter of the base of our can top is a little over seven inches, then proceeding in accordance with the rule $\frac{7 \times 3}{4} = 5.25$, that is to say, four-sixths of a circle whose radius is five and a quarter inches will make our top as shown in Fig. 163. Now add enough on each side for seam parallel with the edge as shown, and the pattern is complete ready for forming.

Now let us see if our oil can will hold a gallon. We find by dividing the number of cubic inches in an imperial gallon, or 277.274 by .7854, we get the number of cylindric inches contained in it thus $\frac{277.274}{.7854} = 327.57$, and if we multiply this result by three we obtain the number of conical inches in a gallon also, thus $327.57 \times 3 = 982.71$. Here then we have the figures necessary for our work, and we proceed. First with the body of the can, which is 7.25 high and 6.75 in diameter, then $6.75 \times 6.75 \times 7.25 = 330.3281$. Next the top, which is 6.75 inches in diameter and 3.70 high, then $\frac{6.75 \times 6.75 \times 3.7}{3} = 56.1937$, and adding these two quantities together we have $330.3281 + 56.1937 = 386.4213$, which shows margin enough over 327.57 that the bottle is of full capacity. The same formula used with an American gallon and a sheet 14 x 20 is a good example for practice.

HOOD FASHION.

The hood, or cap for stove-pipe, is formed of five-sixths of a circle, and is illustrated in Fig. 154. This fashion is used principally for caps for stove-pipe and flat covers, such as lard cans, spice boxes, bucket covers of different kinds, lamp crowns and many similar pieces used in the make up of lanterns and lamps where made by hand.

All these examples named are instances of its use with the base down. Let it be required to make a hood for a stove-pipe eleven inches in diameter, then proceeding by the rule in a similar way as before, we have $\frac{11 \times 3}{5} = 6.6$, or six and six-tenths inches as the radius of a circle, five sixths of which will make the hood required without anything allowed for seam, which must be added parallel with the edges. The foregoing rules I have used for many years. They are simple and practical, requiring but little thought or mathematical knowledge, and for the general run of work sufficiently accurate, and when the system is understood and properly grasped by the learner he will find it one of the most valuable systems for ready application in ordinary work. Sometimes, however, it happens that greater accuracy is necessary in the premises, and we have an example which calls for closer reasoning.

For instance, in Fig. 167 is an example which once presented itself to the writer, and perhaps it has been to the reader. It was required to make a large hood to hang over a smith's fire, *A B C*, Fig. 167, having an angle of one hundred and twenty degrees at the apex, or a rise of thirty degrees from the base. I lined it out on a board in a similar way I had done for a longer taper, as in Fig. 97 and was perplexed to find that the outlines *a b c*, *b d*, *d b a*, or the three figures of the cone or hood required, completed the circle, and I was puzzled to know what part of the circle it was necessary to take out to make the cone required. In the emergency I could only cut and try, and study the matter out after.

I then waded through many books patiently searching years for the required information, and finally found the key to it in an old mensuration by John Bonnycastle, published in 1823, and I here present the result of my search, or its application, for the benefit of the reader, which will be found applicable to resolve cones of any given height or rise from the base or angle at the apex accurately. To illustrate: Let it be required to make a cone, *A B C*, Fig. 168, eighteen inches in diameter at the base, and any height taken at random from the base to the apex, or say eight inches perpendicular, *D B*. Now, we want to know how many degrees of a circle whose radius is the slant height *A B* of the cone *A B C*, it will take to form the cone. To do this it may be shown that where the radius of a circle is 1, half the circumference is 3.14159, and, therefore, $\frac{3.14159}{180} = .01745$, or the length of an arc of one degree. Hence, .01745 multiplied by the number of degrees in the arc, will give the length of that arc. In the example before us, *A D* = 9, and *D B* = 8, then $\sqrt{9^2 + 8^2} = 12.0414$, the radius *A B*, then $12.0414 \times .01745 = .21012$, or the length of an arc of one degree of a circle whose radius is 12.0414. The diameter of the base circle, *A E C*, is 18, then $18 \times 3.1416 = 56.4488$, and $\frac{56.4488}{.21012} = 269.123$, the number of degrees, or the length of that part of the circumference *F A K C H G*, whose radius, *A B*, is 12.0414. To measure or cut off 269.123 degrees from the circle *F A K C H G*, which is 24.0828 in diameter, divide two hundred and sixty-nine and an eighth degrees by sixty degrees, or $\frac{269.123}{60} = 4.485$, that is, four steps or spaces of 60 and nearly one-half of another, which proves to be half way between lantern and hood fashion.

Now step off on the circumference with a pair of compasses four times the radius *A B*, that is, *F A*, *A K*, *K C*, *C H*, and $\frac{485}{1000}$ of another space, as shown by *F A K C H*, and on to *G*, which will be the number of degrees required for the cone *A B C*.

One other example, Fig. 169. Let it be required to make a cone *A B C* or a frustum of a cone having the same slant or fashion), eighteen inches in diameter at *A B*, and the slant height *A C* fifteen inches, then $DC = \sqrt{(AC)^2 - (AD)^2}$, or $\sqrt{15^2 - 9^2} = 12^2$, therefore *D C*, or the perpendicular height, will be twelve inches. Now the slant height *A C* of the cone *C A B*, that is, the radius of the circle *w x y z*, is fifteen, then $15 \times .01745 = .26175$, the length of an arc of one degree of a circle whose radius is fifteen inches, and the circumference of *A B* or base of the cone is $18 \times 3.1416 = 56.5488$, and $\frac{56.5488}{.26175} = 216.0332$, or the number of degrees of a thirty-inch circle necessary to make the cone *A B C*, which proves to be between funnel fashion and lantern-head. Dividing 216.0332 degrees by 60 degrees we get $\frac{216.0332}{60} = 3.6005$, or three steps of the generating radius *A C* around the circumference of the circle *w x y z*, and six tenths of another step on to *E*, which measures off 216.6, or a little more than half way between funnel fashion and lantern-head.

Electricity for Power Transmission.

The use of compressed air is becoming general in all well managed railroad shops for driving special tools, and for a great variety of purposes that hand power was employed upon only a few years ago. It is still, however, an open question whether electricity could not be used to better advantage in many cases, especially where electric lighting has been introduced into a shop.

Mr. G. R. Joughins, speaking on the subject, said: "It is very evident that our modern shops must be equipped with an electric power plant and with an air plant also. It is, therefore, very important to know which power we ought to encourage the use of for driving our small tools. It appears to me that electricity is the proper power to use for all our large machines, such as overhead cranes and transfer tables and such heavy tools as those are, because we can get a very quick movement of tools with electricity which we cannot obtain in any other way.

"You have all perhaps seen some prints given out by the Siemens & Halske Company, of Chicago, which illustrate the use of electricity for driving tools in a machine shop. They have it in use in their works in Germany in such a way that they have done away with shafting entirely. They claim that they make a very much cleaner, nicer shop, and they also claim that they make a saving in motive power required of about 40 per cent. They say that this can be applied to any shop at a cost of about $100 per horse-power. The means which they use is that they have a common electric light plant—the same plant can be used for electric lighting, and they apply a motor to each machine in the shop, so that you can have one machine running without the loss of power. There is no waste of power in shafting, etc. But I think it is a very general feeling that electricity is a very expensive power to use. Although they claim a saving of 40 per cent. in power, I think that those who have used electricity believe that there is a loss of about 60 per cent., and it seems quite possible that it may not be very useful for small tools."

Mr. George Gibbs, who has given the subject of compressed air and electricity great attention, expressed the belief that the efficiency of compressed air in transmitting power is not over 20 per cent. Electricity, on the other hand, he said, has a much wider field of application. Nearly all large railway shops have now an electric lighting plant. This plant can be run at small additional expense for attendance all day long and supply current—have current on tap for special tools, such as transfer tables, hoisting and conveying machinery, staybolt cutters, and a number of other purposes. Where power is used for more than one or two strokes of the piston, I think that the electricity will be found vastly more economical. There are disadvantages, it is true, in the electric transmission, and one of the greatest has been the complication and delicate mechanism of the motor itself. This has been, until very lately, constructed more with a view of being run in a laboratory than in a machine shop. In other words, it will not stand rough usage and its depreciation has been very heavy. But this objection is being rapidly overcome lately, and we can now get motors from all the large companies having a very low rate of depreciation.

Cleanliness Not Rewarded.

"How did you find things in California?" we inquired yesterday of a drummer newly returned from the Pacific coast.

"Nothing but complaints about Congress and general mixing up of opinions as to the cause of the hard times."

"Anything new at all? Any railroad companies talk of buying cars or locomotives? Any extensions projected? Any new shops to be built?"

"Nothing, nothing but torpidity of business mixed with languid hopes that something will happen soon to set the ball of work rolling. The only living movement talked about when I was on the Pacific coast was the Coxey armies and the people were not making fun of the movement either, as they were in the East."

"Can't you give me any item of interest for the paper? Any hundred-mile an-hour runs or any compounds running without fuel?"

"Don't know anything about that," replied the drummer, "but I saw one thing that amused me. I was making a short trip, and was riding in the day coach. It was raining hard, and a good deal of red mud had been carried into the car on the feet of rough looking fellows who had not learned that cleanliness belonged to the moral creed.

"Two Chinamen came on to the train at one station and they kept scraping the mud off their shoes before they left the platform in a way that aroused attention. They walked quietly into the car and sat down on seats facing each other. After a little while they began settling themselves comfortably for a long journey, and they stretched their feet over the cushions, but first took off their shoes evidently to keep from soiling the plush.

"One ferret-faced, pug-nosed apology for a man, who was sitting opposite the Chinamen, eyed them angrily for a few minutes and then cried out:

"'It's a fine pass that decent white people have come to, when they must ride with the stinkin' bare feet of heathen Chinese under their noses!'

"A rush was instantly made for the heathens, and they were roughly handled before an active conductor made his appearance and restored order.

"The Chinamen were given to understand that they might repose muddy shoes upon silk plush cushions, but they must not display their stockings to the gaze of the haughty Caucasian."

Our esteemed contemporary, *Dixie*, of Atlanta, proposes an exposition of American manufactured products in the City of Mexico in the winter of '96 or '97, to be followed by similar expositions in South American countries later, all for the purpose of promoting trade with our neighbors. But how about the fence? Does not the tariff interfere with American trade in the Pan-American republics?

We have received a number of letters saying that the A., T. & S. F. had in service some 10-wheelers with the eccentrics on the forward axle. They are of Baldwin build.

The Elements of Boiler-Making—VII.

SHEET-IRON WORK.

By C. E. Fourness.*

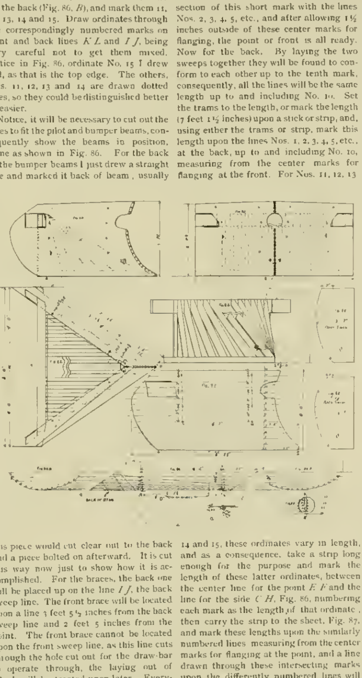
How to Build a Snow Plow. (No. 2.)

In this article I will give another pilot snow plow. The first one, was one sweep the whole length. A great many are not satisfied with that kind, as the snow is very apt to slip over the top at the back, and to prevent this they want the back end to curl over more than the front. Fig 80 is a side and Fig. 81 a front elevation Fig 82 is a plan or top view, showing the pilot with a plow attached. Fig. 84 is the front sweep, and is shown in position dotted in Fig. 83. Fig 85 is the back sweep and is shown in position in Fig. 83 In full lines, the bottom of the front is 4 inches, and the bottom of the back sweep is 7 inches from the base of the pilot, at which points make marks. To find the distance these marks are located from the front, refer to the plan, Fig 82. In this case (Fig 84) the front sweep is 21 inches from the front, and (Fig 85) the back sweep is located 4 feet 2 inches from the former. Draw a line through the marks, and this line will represent the bottom edge of the plow in position. To find the length of the bottom it will be necessary to draw the center line *A B*, and a line *C D* representing the side or one-half the width. Then by measuring along this line (the bottom line) the length is found to be, viz., 7 feet 1¼ inches long; every thing is in readiness now to construct Fig 86. This can be drawn out on a sheet of iron or on the floor in any convenient place (but beware of tobacco chewers, if on the floor, as no place is sacred to some of them), and start by drawing the long line 1 1 1 1, representing the bottom edge of the plow and extending this line far enough at each end to allow the sweep to be drawn at these points. Next, draw two lines at right angles to the bottom line 1 1 1 1, 4 feet 2 inches apart, the sides at these points are to conform to the sweeps in order to have the ends come out right. Now for the point. Draw the line *E F*, the point *F* is 21 inches from the front sweep line *K L*, and the point *E* is 14½ inches from the bottom line 1 1 on the line *K L*. This will cause the line *E F* to occupy the proper angle to the bottom if drawn through these points. Draw *G H* parallel to and 4 feet from *E F* one-half the width of the plow apart, take the sweep of the point or front (Fig. 84) and lay it in the position occupied by Fig 86, *A*, the bottom point at the bottom line 1 1, the top 7 inches from the same line. Take the sweep of the back (Fig 85) and lay it in the position occupied by Fig. 86, *B*, the bottom point at the bottom line 1 1, the top 3 inches from the same line, and draw the curved lines. Space off both these curved lines into fifteen points, keeping in view that the sheet to use is 48 inches wide, and number these points from 1 to 15, beginning with No 1 at the bottom. I failed to mention sooner that the sweeps for each end are just the same from the bottom up to the tenth mark or point, then from these to the top, the back sweeps comes over with a smaller circle, 4 inches nearer to the bottom line than the top of the front sweep. This leaves the top of the back sweep 3 inches from the bottom line 1 1. Now for the ordinates. As both sweeps are similar to No. 10, draw the ordinates from No. 1 to No. 10 clear through between and just cutting the front and back lines *E F* and *G H*, and parallel to the bottom line 1 1. For the remaining ordinates from No. 11 to No. 15, make a short mark across the line *K L*, for the front (at which place the side must be made to conform to the front sweep). These marks are to be made the same distance from the bottom line as they occupy, and mark them 11, 12, 13, 14 and 15, same as on the curved line, Fig. 86, *A*. For the back make a short mark across the line *I J*, at which place the side must be made to conform to the back sweep, these marks to be made the same distance from the bottom line 1 1, as on the curved line for the back (Fig. 86, *B*), and mark them 11, 12, 13, 14 and 15. Draw ordinates through the correspondingly numbered marks on front and back lines *K L* and *I J*, being very careful not to get them mixed. Notice in Fig. 86, ordinate No. 15 I drew full, as that is the top edge. The others, Nos. 11, 12, 13 and 14 are drawn dotted lines, so they could be distinguished better or easier.

Notice, it will be necessary to cut out the sides to fit the pilot and bumper beams, consequently show the beams in position, same as shown in Fig. 86. For the back of the bumper beams I just drew a straight line and marked it back of beam, usually length between those points on ordinate No. 2. Proceed in the same manner until all the length of the ordinates are marked upon the stick from No. 2 (as No. 1 is already found) up to and including No. 15.

Now, as all these marks are upon this strip, all that is necessary is to lay the strip upon each line, Nos. 2, 3, 4, 5, etc., Fig. 87, and mark the lengths successively as they are upon the strip, until all have been treated by this mode of procedure. Considerable time is saved by this method over marking and transferring one or two lengths at a time Make a center mark at the intersection of this short mark with the lines Nos. 2, 3, 4, 5, etc., and after allowing 1½ inches outside of these center marks for flanging, the point or front is all ready. Now for the back. By laying the two sweeps together they will be found to conform to each other up to the tenth mark, consequently, all the lines will be the same length up to and including No. 10. Set the trams to the length, or mark the length (7 feet 1½ inches) upon a stick or strip, and, using either the trams or strip, mark this length upon the lines Nos. 1, 2, 3, 4, 5, etc., at the back, up to and including No. 10, measuring from the center marks for flanging at the front. For Nos. 11, 12, 13 mark Nos. 10, 11, etc., the same number as the ordinate is numbered from which the length was taken. Carry the strip to the sheet, Fig. 87, and set the end of the strip to the center mark for flanging on the lines Nos. 10, 11, 12 and 13, and mark the lengths for the front and back of the beams upon these lines, then a line drawn through the marks will give the line for cutting for the front and back of the opening, for the top a straight line drawn through ½ inch above the line No. 13, and for the bottom a straight line drawn 1½ inches above and parallel to the No 10 line

You will notice that the beam tapers down at the ends, and that the side of the plow comes partly on the tapered and partly on the flat, or parallel part of the beam, which gives the line to cut on for the front of the beam the peculiar shape that it takes. For the holes for the braces, for all of the front, draw a line at right angles to and from No. 6 line up to the top, and for the back draw the line at right angles from No. 6 to No. 10, as the sweep is the same as at the front up to No. 10 line, and above No. 10 line the sheet rolls over more and it throws these two top holes off a straight line, on the straight sheet, and to find the line they are located upon, measure and mark the distance between the lines *E F* and *I J* on the ordinates Nos. 11 to 15, Fig. 86, measuring from the point *E F*, and mark these distances upon the lines 11 to 15, Fig. 87, measuring from the center marks for flanging. Then these holes are, the first 2½ inches from the top, the others 9 inches apart. There is now but one item more, and then the side will be complete, that is the draw-bar hole, for this find the standard height of draft irons on the cars and mark this height of the center of the opening, upon the front sweep less the height the plow stands above the rails, and as the hole in this case is to be 9 inches make a mark 4½ inches above and 4½ inches below this center, and the top of the opening comes just to No. 13 line, and the bottom ½ inch above No. 10 line. In the first plow, the draw-bar hole was square. In this case it is round, and as a consequence it is more difficult to lay out; but that is what we are after, so the first thing to do is to make a view looking right on the front of the plow, and as the only part that is needed is from the No. 10 to No. 13 lines, draw a short straight line, *M N*, Fig. 89, and upon this line draw a circle 9 inches in diameter. Next, mark the vertical distance that Nos. 10, 11 12 and 13 points or marks are apart upon the front sweep, Fig. 86 *A*, and mark these upon the line *M N*, Fig. 89, as shown. Draw lines through these points and mark them Nos 10, 11, 12 and 13. As stated previously regarding ordinates, the closer together the greater the accuracy. Draw a line midway between these lines as shown in Figs. 87 and 89, measure the distance from the center line to the circle upon each line (see Fig. 89) After this is completed, Fig. 88 comes under consideration. This is just the same as Fig 86 at the point, and when laying out a plow that view would answer the purpose. But in this case, as the drawing is made on a small scale, the sweep line coming in there and the figures numbering the lines being scattered around there very promiscuously, this part could not be shown very plainly in that view, Fig 86; consequently, I made Fig. 88. In this figure the line *O P* occupies the same position to Nos. 10, 11, 12 and 13 ordinates as *E F* does in Fig. 86, but in Fig. 88 I only drew the ordinates that were needed for the opening Fig. 89 is a view of the front and gives the width of the opening at the different points, but in order to lay out the opening on Fig. 87 these same widths must be found upon the plan or top view, Fig. 88. Notice the width of the line between Nos. 12 and 13, Fig. 89, is 3½ inches. Mark the distance at right angles to the line *O P*, Fig. 88, upon the extra ordinate between Nos. 12 and 13. Set the dividers from the



this piece would cut clear out to the back and a piece bolted on afterward. It is cut this way now just to show how it is accomplished. For the braces, the back one will be placed up on the line *I J*, the back sweep line. The front brace will be located upon a line 3 feet 5½ inches from the back sweep line and 2 feet 5 inches from the point. The front brace cannot be located upon the front sweep line, as this line cuts through the hole cut out for the draw-bar to operate through, the laying out of which will be treated upon later. Everything is now in shape to tackle the sheet, Fig. 87. Each side requires a sheet 48 inches by 101½ inches by about $\frac{3}{16}$ inch in thickness, and the operation to perform will be to draw the two sweep lines, the front one 21 inches from the front and the back one 4 feet 2 inches from the first. Space off these lines into fifteen points and number them from 1 to 15, calling the bottom edge No. 1 and the top edge No. 15. Draw lines through the points the full length of the sheet, and next in order comes finding the form or line to cut upon for the front end or point. I usually accomplish this by taking a small strip of wood, perhaps 1 inch wide by ¼ inch thick, planed smooth, and have at least one end cut square. Set the square end to the line *L K* on ordinate No. 2, Fig. 86. Make a short mark on the strip where the line *E F* cuts the ordinate No. 2, and make a figure 2 at this mark to designate that this is the 14 and 15, these ordinates vary in length, and as a consequence, take a strip long enough for the purpose and mark the length of these latter ordinates, between the center line for the point *E F* and the line for the side *G H*, Fig. 86, numbering each mark as the length of that ordinate, then carry the strip to the sheet, Fig. 87, and mark these lengths upon the similarly numbered lines measuring from the center marks for flanging at the point, and a line drawn through these intersecting marks upon the differently numbered lines will be the line for shearing at the back. On account of the length of the pilot and bumper beams an opening will be required to be cut on each side to clear, and in order to find the height set the back sweep in place, Fig 83, and mark the height upon the sweep, as shown with the darts, placing these darts ½ inch above and 1½ inches below the beam to clear nicely, then lay the sweep in position, Fig. 86, *B*, and notice the opening comes 1½ inches above No. 10 line for the bottom and the top comes ½ inch above No. 13 line. Take the same long strip used to convey the full length of the plow, and after removing all the marks that are upon it lay the strip on the ordinates Nos. 10, 11, 12 and 13, setting one end at the intersection of the center line *E F* with these ordinates and marking upon the strip the point of intersection of the front line of pilot and back line of bumper beam, numbering each

*Foreman Boiler-maker, C., M. & St P Ry., Dubuque, Iowa point just found to the line O P upon the extra ordinate, and make a mark this distance from the line for flanging upon the extra line between Nos. 12 and 13, Fig. 87. Now for No. 12. This is 4¾ inches, Fig. 89. This distance mark at right angles to the line O P on ordinate No. 12, Fig. 88, and the distance from the point just found and to the line O P, mark upon the line No. 12, Fig. 87, measuring from the center mark for flanging. On the line between Nos. 11 and 12, Fig. 89, the width is 5 inches, this length measure at right angles to the line O P upon the extra ordinate between Nos. 11 and 12, Fig. 88, and the length of this ordinate from the point just found to the line O P mark upon the line between Nos. 11 and 12, Fig. 87, measuring from the ... for flanging. The width for No. 11, Fig. 89, is 4½ inches. This distance measure and mark on the ordinate No. 11 Fig. 88 at right angles to the line O P and the length of the ordinate from the point just found to the line O P convey to line No. 11, Fig. 87, measuring from the center line for flanging. Now for the last ... the extra line between Nos. 10 and 11 Fig. 89. This width again measure and mark it upon the extra ordinate between Nos. 10 and No. 11 Fig. 88 and the length of the ordinate from this point to the line O P convey to Fig. 87, and mark it upon the extra line between Nos. 10 and 11 ... drawn from the center mark flanging on No. 13 line, through these ... of intersection on the different lines, ... ending cutting through the line for ... at a point ½ inch above the line ... will cut to form a round hole when ... up. After shearing and punching ... use it as a pattern for the other ... turn it over before marking off ... flange and fit this plow up similar to the ...

Some Special Tools for Railroad Repair Shops.

We illustrate herewith three special tools that are particularly adapted to roundhouse and shop work.

There are so many places around machinery and boilers where a ratchet drill is the only thing that can be used that the market is flooded with them, good, bad and indifferent—mostly bad.

Cheap malleable iron heads, gas pipe handles and poor work has made the tool generally despised—tolerated as a necessary evil.

The makers of these tools commenced some years ago to build ratchet tools in a new way—by making them as tools should be made. The ratchet head of forged steel, teeth cut by machines, a hollow steel handle, made from bar, and machine fits all around.

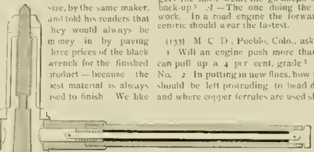
Their ordinary ratchet drill, shown herewith, is a first-class tool, better made than the usual; it is particularly adapted to railroad boiler shops. A square shank drill socket is furnished as shown, and when removed the standard Morse taper socket remains.

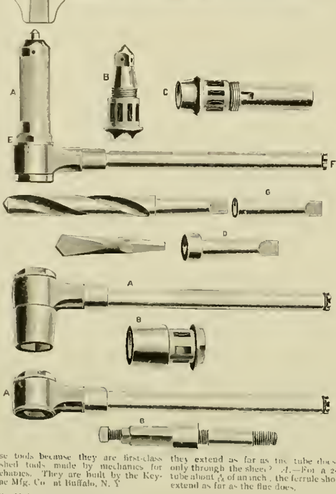
The detail cut shows the plain steel pawl and how it is reversed by lightly pulling and partially turning the knob on the end of the handle. The drill or socket can be discharged by screwing down the feed screw to extreme limit.

The other tools are the ones that will be appreciated in the railroad shops and roundhouse. One is a stud driver, and is the simplest form of ratchet wrench with sets of stud holders, as shown at B. A stud can be driven home with this device without the possibility of marring the thread and without once taking the wrench off the stud. In screwing stud into the holder it "bottoms" on a piece of brass against the set screw in the end. When the stud is home the ratchet handle is held and this set screw slackened off, and the stud is free at once, the threads being a loose fit. Besides its use as a stud driver it is equally useful in driving home screw stays, operating flue expanders, etc.

The other tool is a socket wrench of some use. The socket being of steel is little liable to get out of true. In putting on nuts, especially finished nuts there is no liability to mar them, as every facet bears its share of the strain and the wrench is not removed from the nut until it is home—it is taking off and putting on the monkey or solid wrench that mars work. Besides this the work is done quickly. These two tools for just what work is done on cylinder heads and steam chests in the ordinary roundhouse would pay for themselves in no time at all.

The immortal "Chordal" once wrote some good advice about the difference in value of two monkey wrenches of the same size, by the same maker, and told his readers that they would always be money in by paying three prices of the black wrench for the finished product—because the best material is always used to finish. We like these tools because they are first-class finished tools made by mechanics for mechanics. They are built by the Keystone Mfg. Co. at Buffalo, N. Y.





The Union Car Co. recently turned out a lot of 400 car wheels for a Southern railway. In the test made, which was a very severe one, eight wheels were broken under the drop test, as follows

No. Wheel	No. of Blows to Crack	No. of Blows to Break	Depth of Chill In Tread	Depth of Chill In Throat
32	30	38	¾ in.	⅝ in.
74	21	31	½ "	½ "
119	15	21	¾ "	¾ "
152	9	16	½ "	⅝ "
221	11	19	¾ "	⅝ "
290	16	34	⅝ "	⅝ "
310	14	16	½ "	½ "
354	17	28	½ "	½ "

Previous to the test every wheel was struck nine times under the flange and between the brackets with a 12-lb. hammer. With this severe test none of the wheels were fractured. The uniformity of the chill is the most remarkable feature in this lot of wheels.

? A. What You Want to Know. ? A.

Don't ask questions that simply require a little figuring to determine; make each question separate. No notice taken of anonymous questions.

(131) G. S. B., Brainerd, Minn., asks

Is there a table giving the different temperatures of compressed air at different pressures. *A.*—Not that we know of.

(132) F. W. S., Birmingham, Ala., asks

1. Where can I get photographs of all the old style locomotives that were first made in this country? *A.*—We know of no such collection. 2. Which eccentric gets the most wear, the go-ahead or the back-up? *A.*—The one doing the most work. In a road engine the forward eccentric should wear the fastest.

(133) M. C. D., Pueblo, Colo., asks

1. Will an engine push more than she can pull up a 4 per cent. grade? *A.*—No. 2. In putting in new flues, how much should be left protruding to bead down, and where copper ferrules are used should they extend as far as the tube does or only through the sheet? *A.*—For a 2-in. tube about $\frac{3}{16}$ of an inch; the ferrule should extend as far as the flue does.

(134) W. H., Farlington, Wash., asks

1. Where is the *Firemen's Magazine* published? *A.*—Terre Haute, Ind. 2. What is the answer to question 21 on your Educational Chart No. 1. *A.*—The valve would close the port before the piston reached the end of its stroke, and the compression would lift the valve up, causing it to rattle or chatter on the seat. You can notice this when engine is shut off any time before lever is dropped down.

(135) W. M. M., Moncton, Can., asks

How much coal will a 9½-in. air pump burn in ordinary service, keeping up 70 to 90 pounds of train pressure with a 1½-in. exhaust pipe into front end? *A.*—We do not know. The exhaust pipe size has nothing to do with the steam consumed, the pump is governed by the train pipe pressure and is shut off when full pressure is reached. The steam used in pump in actual service is usually used when the engine is shut off and the pops going. Coal consumed by the air pump depends altogether on what the pump is doing.

(136) C. S., Spokane, Wash., writes

Is it necessary to disconnect engine if, when backing up, you break go-ahead eccentric strap? I had such an accident and did not disconnect, but took off broken strap and worked engine at full stroke—ran to end of division. Do you consider it perfectly safe to run engine in such shape? *A.*—We do not consider it safe to do this. It is far safer to run ahead with the back-up eccentric rod down, as there is not the tendency to swing the link into a cramping position. That it is done safely is not always proof that it is safe. Many a man has brought in an engine with one side rod up, but many a pin has been taken off that way.

(137) A. W. W., Beardstown, Ill., writes

We have been having a little discussion at the shop in regard to an air-pressure problem, and I thought I would ask you about it. If one air jack will lift 10,000 (ten thousand) pounds at 100 (one hundred) pounds pressure, how much will two jacks lift if both are connected to the same reservoir? Some say that one jack would lift as much as a dozen, and others say that every jack you add will each lift 10,000 (ten thousand) pounds. Now, which is correct? *A.*—If the pressure in reservoir is the same (100 pounds) each jack will lift an equal amount, or 10,000 pounds. If this were not so, area of piston would cut no figure, and a 1-inch piston jack would lift as much as one with a piston 1 foot in diameter. It is merely a case of increasing the cylinder area. Will your engine pull as many cars with one cylinder as with two?

(138) W. E. T., Charlottesville, Va., writes

1. Will you kindly advise through the columns of your valuable paper on the following subject: How far can an engine be run with main rod up, with the ports covered, without damage to the cylinder, and is there any way to get oil in the cylinder in such a case? *A.*—We do not know how far an engine could be run in this condition. It is not safe, and much damage may result from a trial. 2. Is it safe to run an engine without disconnecting the back motion eccentric in case the forward one was broken or *vice versa*, if so, under what conditions? *A.* This has been done, and is not unsafe under most circumstances. It is better to only run in this condition until relief can be had or the train gotten out of the way. Circumstances alter cases, and should always govern the man in the emergency. There are times when great damage to engine may be risked to save greater disaster or more expensive delays.

(139) J. T. T., Albany, Ga., writes

My friend contends that the crosshead of a locomotive stands still on each dead-center, while the crank pin moves a distance of half its diameter across the center line. I say it does not, but continues to move until crank pin gets to center line and starts back when crank pin passes center line. Who is right? *A.*—This is one of those useless kind of questions, but is a point often quarreled about. The best way to reason on such a thing is to carry your figuring to extremes. Suppose now, your friend had a locomotive, one side with a one-inch pin and the other with a ten-inch pin, would one crosshead stand still while the big pin traveled five inches, and the other crosshead stand still only while the small pin traveled half an inch? In either case the wheel would have to travel as far as the pin. The crosshead stops at each end of the stroke and starts back as soon as the pin leaves the center. 2. In answer to question 129 in September, you said to hook-up a direct-motion engine toward center would increase the lead. I say it will diminish and not increase the lead. Were you not wrong? *A.*—No, we were right. A direct-motion gear *may* be put up so as to decrease the lead but is seldom, if ever, done purposely. How can the use of a rocker arm change the increase of lead due to movement of the link? It merely acts as a rod to convey motion to the valve, but as the top moves ahead when the bottom is moved back, and *vice versa*, it causes the valve to open one port while the direct motion would open the other one.

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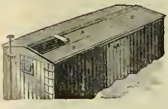

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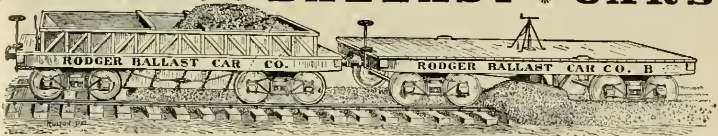

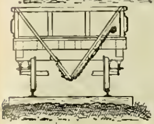

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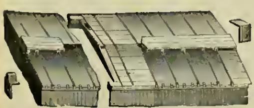

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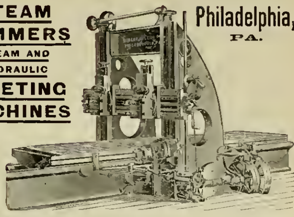

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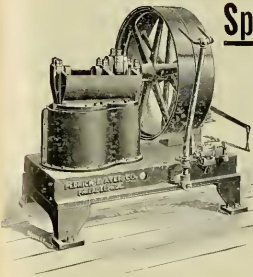

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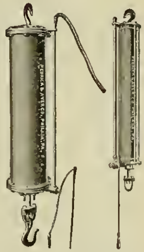

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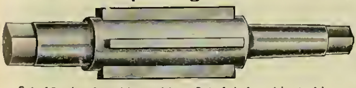

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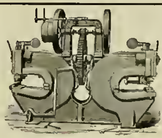

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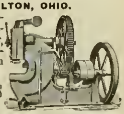

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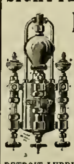

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Cannot cross-feed.

No broken glasses by wear of steam and water.

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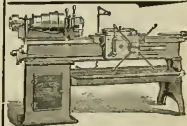

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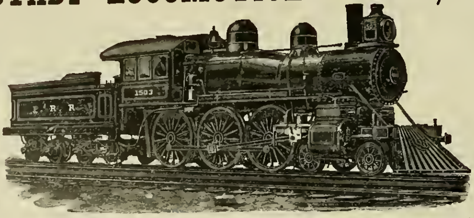

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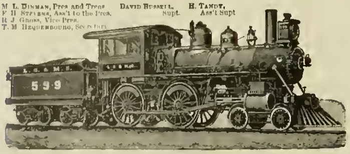

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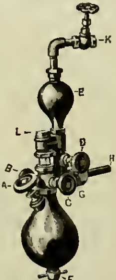

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Perfect distribution of oil to both cylinders from one feed glass, and entire efficiency under all working conditions.

Only One Glass,

and that short and stout; almost unbreakable. Absolutely no use for any more. They are an unnecessary source of trouble and danger.

Write for full particulars.

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Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock.

VOL. VII, No. 11. NEW YORK, NOVEMBER, 1894. 20 Cts. Monthly / $2.00 Per Year.

Heavy Eight-Wheeled Passenger Locomotive for the Boston & Albany Railroad.

The Schenectady Locomotive Works have recently turned out some fine eight-wheelers for the fast "Boston and Chicago Special Limited" train of the B. & A road, that our artist has shown in the accompanying engraving.

These engines were designed to run over the mountains between Albany and Springfield, and were expected to haul six vestibule cars, two Wagner sleepers, a diner, two day coaches and a baggage car. The first two engines built are now doing this work successfully.

In designing these engines the builders were limited to 74,000 pounds on the drivers, and did a very sensible thing in scheming to lighten other parts, and put as much as possible of this weight into the boiler.

They made the driving-wheel centers, driving boxes, eccentrics and straps of gun metal, thereby getting the same strength as cast iron with less weight.

The revolving and reciprocating parts were also the subject of special design to lighten weight, and that they succeeded is shown by the actual weight of these parts. The piston complete (with a 3½ inch rod) weighed but 304 pounds, the crosshead 202 pounds, main rod (I section) 422 pounds, side rod 246 pounds. The crank-pins are hollow, the main pin weighing 110 pounds and the back pin 104 pounds.

The builders believe that these engines have the largest boiler capacities of any engines of the same weight in this country.

The general dimensions of the engine are as follows

Fuel, bituminous coal.
Gauge of road, 4 ft. 8½ in.
Weight of engine, in working order, 114,700 lbs.
Weight on drivers, 74,000 lbs.
Wheel base, driving, 8 ft. 6 in.
Wheel base, rigid, 8 ft. 6 in.
Wheel base, total, 22 ft. 11 in.

CYLINDERS AND VALVES

Diameter of cylinders, 19 in.
Stroke of piston, 24 in.
Horizontal thickness of piston, 4½ in. at rim, 5¼ in. at hub.
Kind of piston packing, cast iron rings.
Kind of piston rod packing, U. S. metallic.
Diameter of piston rod, 3½ in.
Size of steam ports, 18 in. long by 1¼ in. wide.
Size of exhaust ports, 18 in. long by 2¾ in. wide.
Size of bridges, 1⅛ in. wide.
Greatest travel of slide valves, 5½ in.
Outside lap of slide valves, ⅞ in.
Inside lap of slide valves, none, line and line.
Lead of valves, in full stroke, 1/16 in.
Kind of slide valves, Richardson balanced.
Kind of slide valves stem packing, U. S. metallic.

WHEELS, ETC.

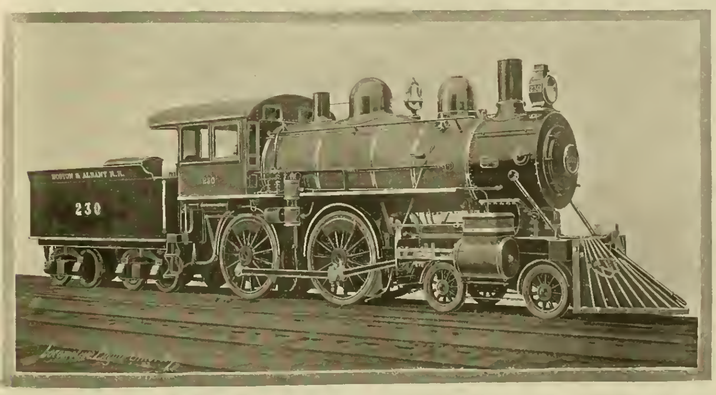
Diameter of driving wheels, outside of tire, 69 in.
Tire held by shrinkage and retaining rings
Diameter and length of driving journals, 8 in. diam. by 11 in. long.
Diameter of engine truck wheels, 33 in.
Diameter and length of main crank-pin, journal, 5½ in. diam. by 5½ in. long.
Diameter and length of side rod crank-pin journal, 4½ in. diam. by 3½ in. long.
Driving box, material, gun iron.
Engine truck wheels, Snow boltless steel tired.
Driving springs, hung underneath the driving boxes.
Driving springs, centers, 42 in.

BOILER.

Style, extended wagon top.
Outside diameter of first ring, 60 in.
Working pressure, 190 lbs. per sq. in.
Material of barrel and outside of firebox, carbon steel.
Thickness of plates in barrel and outside of firebox, 9/16 and 5/8 in., 7/16, ½ in.
Horizontal seams, butt jointed, with welt strip inside and outside.
Circumferential seams, double riveted.
Firebox, length, 90 1/16 in.
Firebox, width, 40⅛ in.
Firebox, depth, F. 71¼ in., B. 59¾ in.
Firebox, material, Schoenberger steel.
Firebox thickness, crown ⅜ in., tube ½ in., sides and back 5/16 in.
Firebox water space, front 4 in., sides 3½ in., back 3 in.
Firebox crown staying, 1 in. radial stay-bolts.
Firebox stay-bolts, Taylor iron.
Tubes, material, charcoal iron No. 13 W. G.
Tubes, number of, 298.
Tubes, diameter, 2 in.
Tubes, length over tube sheet, 11 ft.
Heating surface, tubes, 1703.3 sq. ft.
Heating surface, firebox, 141.4 sq. ft.
Heating surface, total, 1844.7 sq. ft.
Grate surface, 25.29 sq. ft.
Grate, style, rocking, in two sections.
Ash pan, style, sectional, with dampers F. and B.
Exhaust pipes, double.
Exhaust nozzles, 3¼ and 3⅜ diam.
Throttle, balanced valve, double poppet
Smokestack I. D., 14 in. at center, 16 in. at top.
Smokestack top above rail, 14 ft. 1½ in.
Boiler supplied by two No. 10 Mack injectors, placed right and left.

TENDER.

Weight, empty, 37,200 lbs.
Wheels, number of, 8.
Wheels, diameter, 36 in.
Journals, diameter and length, 4½x8 in.
Wheel base of tender, 14 ft. 2 in.
Tender frame, 7 x 3½ x 1 in. angle iron.
Tender trucks, side bearing wood bolster.
Water capacity, 4,000 gallons.
Coal capacity, 8 tons
Total wheel base of engine and tender, 45 ft. 11 ins.
Total length of engine and tender, 55 ft. 7½ in.
Engine fitted with Westinghouse-American combined air-brake on front side of all drivers, on tender, and for train.
Martin's steam car heating apparatus.



Heavy Fast Passenger Locomotive for the Boston & Albany Railroad.

A Trip to North Wales.

(EDITORIAL CORRESPONDENCE.)

The city of Manchester in England is the center of what is probably the most densely settled manufacturing district in the world. It is good for regions of this kind to have ample recreation and breathing ground; it is good to have places where workers can go out to breathe the pure air of heaven or to surcease for a time the cares of business. One cannot be long among Englishmen without feeling that from the workman to the merchant prince, there is a much more healthy sentiment about the necessity for rest and recreation than there is among the toilers of America. It is looked upon as a matter of course that everybody shall get out of the city as long and as often as circumstances will permit during the summer months. The workman with his wife and children get out to the popular resorts in the neighborhood of Manchester on Saturday afternoon and on Sunday, and those with more money to spare go to the sea-side, to the lakes or to the mountains.

The railway companies of Great Britain have encouraged this tendency of the people to make holiday journeys by giving low excursion rates and giving the best possible train facilities. From every industrial center of the British Isles are to be seen in summer and when the weather is fine, heavily loaded special trains carrying multitudes of people towards the green pastures, the seashore and the wooded uplands. This business is a valuable source of revenue to the railway companies and is a real benefit to the communities.

The favorite health resorts for the business men of Manchester are in North Wales. I lunched one day with that genial prince of machine manufacturers, Sir William Bailey, the Mayor of Salford, and the magistrates of the borough which is to the city proper of Manchester what Brooklyn is to New York, and it appeared that every one had just returned from North Wales or was about to go there. The beauties and attractions of the region were praised so lavishly that I made up my mind that an editorial traveler was not doing himself or his readers justice by failing to visit North Wales. While I was hesitating between two opinions my brother mentioned that a tour through the eulogized district would take me to the famous Britannia tubular bridge over the Menai Straits, and that decided me.

The journey was something to be remembered. We went from Manchester to Liverpool by train over what most students of railway history consider the most famous railway in the world. This is the Liverpool & Manchester Railway, now a part of the London & Northwestern system, which was constructed under the direction of George Stephenson, and where the "Rocket" first demonstrated the great possibilities of rapid transportation. It is a short line, only 54 miles long, and a traveler over it now has difficulty in appreciating the reputed stupendous feats of engineering displayed in overcoming the obstacles which were encountered. The country is fairly level, and an American engineer would probably undertake to build a first-class line through the district for $30,000 a mile. This Liverpool and Manchester line cost $3,700,000 for the 54 miles, an average of about $68,500 per mile. Much of the enormous expense was, however, incurred through the opposition of land owners and others who hated this greatest innovation on the old order of things that the world had ever seen. The necessity for organizing the carrying on of novel operations and the expense of educating men to do work they had never performed before added greatly to the total cost. There was also tremendous opposition to the enterprise presented when application was made to Parliament for the right to build the road, and it looked as if this opposition was overcome by payment of sums which would make even New York aldermen green with envy.

There is some exceedingly heavy rock cutting in the neighborhood of Liverpool. There are several large viaducts and bridges, all of solid masonry, and the embankments have been rather costly, but on the greater part of the line the work is light.

We pass over the historic Chat Moss, which was so deep and soft that it seriously threatened for a time to stop the advance of the line in that direction. This terrible moss is now covered with fertile fields where herds of kine look up lazily at the passing train. Another historic place is Rainhill, where the competition of locomotives took place which gave Stephenson and his "Rocket" fame that will endure as long as railroads are used.

Conway Castle and Tubular Bridge.

I had hardly begun to meditate on the wonderful harvest that had been reaped by the seed of which the Rainhill contest was the first fruits, when we were in Liverpool.

Without loss of time we found our way to the harbor, and there boarded a boat that looked like those which trade between New York and Staten Island. A particularly mixed freight of passengers was quickly aboard, and we were soon steaming down the Mersey. For half an hour we watch the interesting variety of craft dancing on the channel that leads to England's maritime metropolis, and then we find that we are drawing away from the main artery of commerce and begin skirting the coast, which gradually becomes bolder and more picturesque. We traverse channels with unpronounceable names, and watch tiny isles rising out of the water, where wealth has established many a summer home set up in positions to catch the breeze and to excite attention. All along the coast is dotted with small villages with the peculiar "summer residence offered at reasonable terms," which seems to be a stereotyped feature of all places where the unwary are allured into temporary abiding places by the seashore. Were it not that the background is more rugged and imposing, a stranger might readily mistake the sights on the coast of North Wales for those on New Jersey.

The tiresome thing about all such places is that they are so much alike. Even the health resorts on the Pacific Coast have little to distinguish them from the "genteel cottages" for rent on the coast of Wales

But these Welsh places have attractions that are all their own. They have a peculiar form of mountain that looks like a peak of the Rockies with its head well combed, the inequalities smoothed down and plasters of green foliage stuck fitfully about the cranium. But on the level parts these green extents take full posession, and make luxurious pictures rich beyond comparison of varied verdant hues. They have greenness that makes the emerald look yellow and a variety extending from blue to yellow.

But the thing that makes a modest wanderer stand aghast is the spelling and pronunciation of the names. An acquaintance we had forgathered with was just telling me about the achievements of the famous engineer Telford in building a suspension bridge over the Menai Straits at Inys-y-moch when the suspension bridge and the famous Britannia tubular bridge came in view. The place for landing was reached immediately afterwards. The engraving that accompanies this article gives a good idea of the appearance of the bridge as seen from a neighboring height. The first and parting impression of the structure was disappointment. But that feeling vanished when I had time to reflect that the work was done by an apprentice hand in bridge-building and that the knowledge and skill learned in the construction of works of this character prepared the way for successfully building the Forth and the Brooklyn bridges.

The coast of Wales resembles roughly a rugged human face, with the nose protruding out into the Irish Sea, forming the closest land connection with Dublin. This nose originally adhered firmly to the mainland, but by some of the tumultuous convulsions that the earth has sometimes suffered from the nose was broken away and an opening made through which the sea flows. This is Menai Straits. The broken off part is the island of Anglesea, a rich and fertile piece of country which for centuries was a granary and packing house for the people of England. To render intercourse easy between the island and the mainland was very desirable, but was not easily accomplished. The tide, which rises and falls from 20 to 25 feet, rushes through the straits with a violence that the most turbulent days of Hell Gate never approached The only method of crossing up to 1825 was by ferry boats, and even these could not have been very good, for there were a number of accidents where hundreds of people were drowned. In 1825 Telford finished a suspension bridge across the straits which brought security.

Shortly after the railway era began certain English capitalists perceived the value of an enterprise that would build a railway from England which would end at Holyhead, the point on Anglesea nearest to the Irish coast. This led to the organization of the Chester & Holyhead Railway, which was constructed under the supervision of Robert Stephenson as chief engineer. As the work progressed the chief engineer had to solve the problem of spanning the Menai Straits with a bridge that would carry a railway train. It was a new feat in engineering. There were peculiar difficulties thrown by the Admiralty in the way of the erecting of a bridge over the straits. That board, always noted for the thickness of skulls of its members, would allow no scaffolding to be employed in the erecting of a bridge lest it should interfere with navigation. The first idea was to erect cast iron arches, but the opposition of the Admiralty dolts caused the plan to be abandoned. Then the idea of a tubular bridge was conceived.

An accident to a ship in the Thames convinced Stephenson that he could make a tube of sufficient strength to span the Menai Straits and carry a railway train safely In launching an iron ship an accident happened which left her resting on the bow and stern during several tides, the distance between points of support having been 110 feet. When the vessel was got into the water it was found that the plates had been sufficient to sustain the weight without injury to any part

After a great many experiments to test the resistance offered by various forms Stephenson decided on a rectangular section for the Britannia Bridge. The bridge, as built, consists of two independent continuous tubes about 15 feet wide and varying from 23 to 30 feet in height. It has four spans 100 feet above high water two 460 feet in length and two 230 feet long The success of this bridge led to the building of the Victoria Bridge across the St Lawrence at Montreal, which Stephenson also designed. This form of bridge is now obsolete, because it does not distribute the metal in the best form for obtaining the maximum strength, but it inaugurated a revolution in bridge construction. Before Stephenson had the courage to use the tube it was supposed that the arch was the only form that could be employed for a long span.

From Menai we came back by the Chester & Holyhead Railway—now part of the Northwestern, which was engineered by Robert Stephenson. The line follows a very rugged route, and there are numerous tunnels, rock cuttings and sea walls that have been erected to keep the Irish Sea from taking entire possession of the railway structure. It is said that the waves hit the rocks on some parts of the coast with an impact of about two tons to the square foot

The whole part of this railway which I was able to examine gave me the opinion that it was the most substantially built structure I had ever seen. Everything is designed as if traffic and the elements were conspiring to tear the whole apart, but Mind, more powerful than all destructive forces, had fashioned shields which were impregnable.

We stopped off and visited a variety of attractive scenes, almost every mile opening up new beauties of a character rarely seen elsewhere. The picture marked "Penmaenmawr" shows a scene that is

Britannia Tubular Bridge

located with varied settings on many parts of this coast. The older part of the place, which is called Dwygyfylchi, is remarkably picturesque, and there are numerous places about that have interesting historical associations connected with them. On the summit of a hill called Pen-y-dinas is the ruin of a castle, the fortifications of which are said to have been capable of accommodating twenty thousand men. It was here that Gruffyth-ap-Lleyllyn was assassinated while bravely defending his country against Harold the Saxon. This is a rather sterile district of the slate raising quality. I have always noticed that a naturally famine-producing country has always been valiantly defended by the natives against invaders.

We were told that we missed much by not being able to linger for a day or two amidst the rustic shades of Llanfairfecham, near which is Llyn-Nanhafon, a beautiful lake, and Y-Foel-Fras Druids' circle, which every one with antiquarian sympathies ought to examine. We preferred to move towards Conway Castle, which holds the distinction of having a railway underneath part of its ancient foundations. The railway bridge behind the suspension bridge, in the illustration, is a tubular bridge erected by Robert Stephenson, about the time the Britannia Bridge was put up.

Conway Castle is the most extensive ruin I have ever seen. It looks like a town of towers and battlements. The place was built a century before Columbus discovered America, and part of its foundations were laid on the site of a monastery that dated back towards the infancy of the Christian religion.

The castle was built by the first English king who ruled Wales after the conquering of the material life of that country. The new rulers evidently believed that they had a troublesome time in prospect, if we are to judge by the strength and number of the strongholds they erected. This castle was built in the form of a parallelogram, on an elevated rock, which was partly surrounded by water. On the outside eight massive embattled towers, forty feet in diameter, with walls of enormous thickness, formed the principal lines of defence. A town of smaller buildings were inside.

Conway Castle figured conspicuously in many of the internecine wars of England. When the people made up their minds to do without kings and rebelled against the high-handed acts of Charles I, Conway Castle was persistently held by a warlike archbishop for the king. Cromwell proved too powerful for royalty, and the Parliamentary party got possession after a time. When Charles II came back to the throne he rewarded those interested in Conway Castle in the way the Stuarts were notorious for rewarding those who stood by them in the day of adversity. To help to maintain the extravagance of his dissolute court he sold the lead roofing of Conway Castle, and from that day the magnificent structure began to descend to the condition of a roofless ruin.

But there is little in that of interest to railroad readers. We return by Chester and Crewe with the consciousness that the short tour through North Wales has been one of the most enjoyable outings of two months' rambling. Any of our railway friends who make a pilgrimage to Crewe, the famous industrial center of the London & Northwestern Ry., can make the trip to Menai Straits and back in one day. A. S.

Penmaenmawr.

Human Flesh and Blood as Steel-Tempering Material.

In following up the history of human progress we find that steel has exercised an extraordinary influence in advancing the arts and in developing industries. Looking at the improvements in steel-making that are within the memory of middle-aged people we find ourselves witnessing a steel revolution such as the world is never likely to see again. The effects of Bessemer's invention which made steel direct from the ores are more important to the world than any other event that ever happened. Emperors, kings, princes, lawgivers and generals have at times made a slight scratch on the surface of the globe. Compared to the greatest feats performed by these people the work of Bessemer is a deep chasm which will endure for all time.

More than five-quarters of a century before Bessemer's time there was another master of steel-making who put his stamp upon the art and made the kind of discovery that men never forget. This was Benjamin Huntsman, of Sheffield, England, who discovered the process of making cast steel. His process produced the tool steel which has done so much to develop our mechanic arts.

When we look back beyond Huntsman's time for another hero of steel development, we encounter a fog of uncertainty that research cannot fathom. We find, away back in the portals of metallurgical history, mention of famous steel, but who originated the methods of production is away beyond human ken.

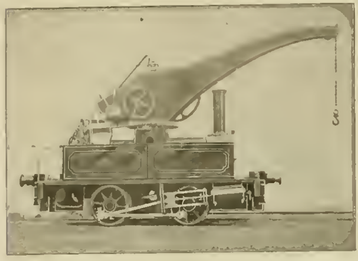
The most famous of the ancient alloy of iron and carbon was called Damascus steel, and was used for making swords which were known as "Damascus blades." This

Tan-y-Bwlch, North Wales, and Two-Foot Gauge Railway

steel was of a variegated, watery appearance, and was made principally in the ancient city from which it took its name. The name of Damascus, in itself, was enough to give fame to a good steel, for it was an important town in the time of Abraham. Up to modern times no steel had displayed tenacity, edge-holding qualities and hardness equal to Damascus steel. The process of its manufacture has been always a mystery.

A discovery reported by a German professor may shed a ray of light on some grim methods connected with the tempering of Damascus steel. He reports that in making excavations in ancient Tyre he found the shop of an ancient armorer with a quantity of sword blades in different stages of manufacture, though badly corroded. A copper cylinder with a close-fitting cap was found among a pile of dry rotted wood, evidently the remains of an arm-chest, the brass nails and copper bands of which had retained their original form. This cylinder contained a parch-

When the train stopped at Robesonia, twelve miles west of Reading, the fireman was startled by seeing a tall young man, all covered with ashes, stick his head out of the opening below the firebox door and ask, "How far is it to Reading?" "How did you get in there and where?" asked the fireman. "At Harrisburg." "And



They are built of different sizes to suit the business of the yards they are intended for. Nearly all railroad repair shops have one or more of these cranes about the yard handling material, and they are reported to be a great convenience.

A Dangerous Practice.

Fireman Frank D. Brady, employed on the Brooklyn Elevated road, was killed last month by falling off the engine. He was cleaning the jacket.

This is a practice that should be prohibited on every road, not so much to keep from killing the men who practice it as for the fact that it is dangerous in other ways.

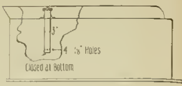
Every locomotive is entitled to the use of four eyes when running; anything that lessens this number tends to let down the barriers a little and increase the chances of other avoidable accidents.

Means of Applying Boiler Compound.

The Minn & St L road, like others in the northwestern country, have considerable trouble on account of bad water, and the water in the various tanks has been carefully analyzed and classified according to the standard R. R. Chemists' rules, as follows

8 to 15 gr.	solid matter	per gal	very good.
15 to 20 "	"	"	good
20 to 30 "	"	"	fair.
30 to 40 "	"	"	poor.
40 & over "	"	"	*bad.*

manner, as per sketch. This pipe is closed at the bottom and perforated on the sides



close to bottom with four 1/8-inch holes. The pipe has a suitable cap or cover at top.

"There are strange things about the way some locomotive improvements work," remarked a well-known railroad man in this office last month. "Just before leaving home I was reading the report sent out about a locomotive with an improved valve gear Two engines of the same class had been kept upon the same runs for months, one of the engines having the link motion and the other one the improved motion A close record of the coal and water used by both engines was kept. The saving of coal for the improved valve motion was about 10 per cent., but at the same time it was shown that this engine always used more water than the other one Now, gentlemen," he said "what I want to know is, how did the engine burn less coal while evaporating more water? If the valve motion saved steam, what came of the extra steam evaporated?" We gave it up.

In June fifty-eight engines on the M. & St. L. Railway made 147,162 miles, with a total cost of $23,355 71, or a total cost of 15 87 cents per mile. They ran an average of 90 17 miles to a pint of valve oil 38.40 miles to a pint of engine oil, and 46 01 miles to a ton of coal. Some of the boys think this is first-class work, and so it is—especially the coal record.

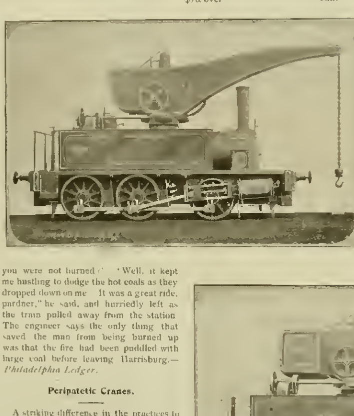
The Prescott & Arizona Central Railroad has entered suit against the Atchison Topeka & Santa Fé, claiming $500,000 damages, owing to the failure of the Atlantic & Pacific to fulfill a contract made by the plaintiffs.

ment inscribed in ancient Syriac characters and in a fair state of preservation The professor, after months of close study, has pronounced it an extraordinary discovery—one calculated to cast much light upon the heretofore mysteries of the ancient craft of weapon-making, giving in detail the methods followed in making the perfect Damascus blades.

The manner of tempering these blades when intended for a ruler or an officer of high rank was as follows "Let the high dignitary furnish an Ethiopian of fair frame and let him be bound down, shoulders upwards, upon the block of the god Bal-hal, his arms fastened underneath with thongs; a strap of goat skin over his back and wound twice around the block, his feet close together lashed to a dowel of wood and his head and neck projecting over and beyond the end of the block . . . Then let the master workman, having cold-hammered the blade to a smooth and thin edge, thrust it into the fire of cedar wood coals, in and out, the while reciting the prayer to the god Bal-hal, until the steel be of the color of the red of the rising sun, when he comes up over the desert toward the East, and then with a quick motion pass the same from the heel thereof to the point, six times through the most fleshy portion of the slave's back and thighs, when it shall have become the color of the purple of the king Then, if with one swing and one stroke of the right arm of the master workman, it sever the head of the slave from his body and display not nick nor crack along the edge, and the blade may be bent round about the body of a man and break not, it shall be accepted as a perfect weapon, sacred to the service of the god Bal hal, and the owner thereof may thrust it into a scabbard of asses' skin, brazen with brass and hung to a girdle of camels' wool dyed in the royal purple."

A Perilous Ride.

Probably one of the most thrilling rides ever heard of occurred on the Lebanon Valley branch of the Reading road on September 8th. A young man crawled into the ashpit of a Wootten engine at Harrisburg. The pit is divided in two sections, and both are directly beneath the fire grates. He entered through under the door of the firebox and took a seat in the second compartment, unobserved by the engineer or fireman. Shortly after taking this position the engine was attached to the fast line and started for this city.

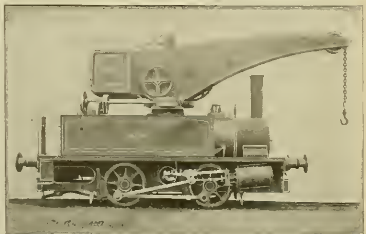


you were not burned?" "Well, it kept me hustling to dodge the hot coals as they dropped down on me It was a great ride, pardner," he said, and hurriedly left as the train pulled away from the station The engineer says the only thing that saved the man from being burned up was that the fire had been puddled with large coal before leaving Harrisburg.—*Philadelphia Ledger.*

Peripatetic Cranes.

A striking difference in the practices to be seen in American and in European freight yards is in the methods followed for loading and unloading heavy material. In the American yard extremely heavy weights are generally handled by backwoods methods In the early days of railroading there were always to be found men who could move heavy weights by the aid of a few blocks and crude levers, and that practice set the fashion which is still adhered to. In European countries men were not accustomed to lifting an article weighing five or six tons by means of skids, and therefore proper appliances had to be provided. The proper article was a crane which was provided in the yard of even the smallest station.

In large yards it was often found inconvenient to get the cars to the cranes, and this led to the building of locomotive-cranes similar to those shown in the annexed engravings. These forms of peripatetic crane are built by Dubs & Co., locomotive builders, in Glasgow, and the demand for them is every year increasing.



Tanks on the Pacific division run from 7 4 to 40.3 grains to the gallon.

On this same division they were unable to keep a set of flues intact six months. This difficulty led Mr. Tonge, the M M., to try the "Tri-soda Compound," which has worked wonders and has proven a legitimate cure. The water is made perfectly clear, no precipitation or rust, whereas before the use of this compound the reverse was true.

One quart of the Tri-soda Compound per 100 miles is used, and is placed in a three-inch pipe let into the tank in a suitable

It has been decided to hold the next meeting of the Association of Railroad Air-brake Men at St. Louis on the second Thursday in April next

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The boiler of a locomotive belonging to the Delaware, Lackawanna & Western exploded on the Bloomfield branch last month while pulling a passenger train The explosion started with a fracture of an inside side sheet near the mud ring The force of the explosion made the engine turn a somersault The fireman was killed and the engineer fatally injured.

Taking Water on the Fly.

There are thousands of railroad men who have never seen a track tank, and more who never saw a locomotive scoop water without stopping.

The track tank and scoop were invented by Ramsbottom, superintendent of machinery of the London & Northwestern, in 1858, and is now in extensive use in Great Britain, and in the Eastern States of the Union.

The track tank is usually about 18 inches wide, 6 inches deep and 1,200 feet long. It has a steam pipe connection to prevent freezing in winter.

The tender is provided with a jointed scoop that is let down by a lever in the cab; its open mouth drops into the tank and the speed of the train forces the water up the spout; this turns near the top of engine tank and empties into it.

In America the speed is reduced to about 25 miles per hour in order to scoop water, but in England they scoop at full speed. Their engine tanks are made stronger to stand the flow, their scoops are better, and the lines so well guarded that pieces of coal or stones do not get into the tank trough.

Mr. Blauvelt photographed this engine when she was doing the scoop act at 25 miles per hour, and the spray of water can be seen beside the tank.

This was an exceedingly clever piece of photograph work, as the camera must be close to the track and the shutter opened when the engine was but three rail lengths away. The ordinary photographer snaps quick and gets away. Mr. Blauvelt is enthusiast enough to get wet for the sake of a good negative of what he wants.

Copyright ... W. ...

Double Tracks and Tanks (N. Y. & L. B. Railroad) Near Long Branch, N. J. Engine Scooping Water, Running 25 Miles per Hour.

Crossing the Ocean.

[EDITORIAL CORRESPONDENCE.]

On a scorching day in the end of July I found myself on the good ship *La Touraine* steaming down New York Bay bound for Havre and thence for a free-and-easy tour through Europe. I have tried various ways of courting rest and recreation, but I know of no way in which complete cessation from toil can be so thoroughly accomplished as by taking an ocean voyage. No mail to look for, no telegrams to drive you to business, nothing but lethargy around you, and no temptation to escape from pure lazy rest.

As we steam out into the ocean on the first morning, we find most of the passengers trying to locate themselves, with their chairs, rugs and books, on the deck in the points most suitable to the individual tastes. Some try to get the places where they can display themselves to the best advantage, others look for the most sheltered nooks, and others again, with a view to the future, select places where they can spring to the rail conveniently and hold their drooping heads towards the rolling billows that seem to draw the dainties from the strongest stomachs.

Long Island disappears, and the ceaseless thud of the engines pushes the great ship with relentless force through the corrugated surface of the ocean. Hour after hour, day after day and night after night the great pulse of the propeller keeps up its monotonous rhythm. Fogs may rest upon the deep so thickly that vision is suspended and movements about the deck be guided by touch alone; the waves may rise and dash over the vessel with fury that appears destruction, and the eerie wail of the fog whistle may drown all other sounds, but the throb of the screw goes on without a break, and its note brings the comforting feeling that the promised land, always welcome, will loom up at the appointed time.

An observer who is in a condition to watch things soon finds that the population of an ocean steamer is a miniature of society as found ashore. In a very few days the passengers assort themselves in groups according to their real or imaginary standing, and the grades become more clearly defined day after day if the waves do not step in to exert a temporary leveling effect. From the experience of land and of many sea voyages, I have come to the conclusion that the further you descend in the social scale, the more enjoyment you find going on among the people. The temporary inhabitants of *La Touraine* were no exception to this rule. The steerage passengers exhibited a decided lack of familiarity with water. Some of them lounged round all day on the deck basking in the sun, and children brooded round their mothers like chickens under the wings of a hen, but old and young were in for taking all the enjoyment to be got. All day long there was music and dancing and games and frolics. The laughter from the steerage was the most cheering sound heard on the voyage. The music was not always melodious, but it was hearty; it fanned hilarity and helped to beguile the monotony of the voyage. A few of the "upper" classes got some small enjoyment from watching the ongoings of the lower strata, but most of the saloon passengers gloomed around, too dignified and exclusive to make enjoyment for strangers or to associate with people to whom they had not been regularly introduced.

The smoking-room, which is the democratic headquarters of the upper classes, was about the same here as on all other steamers. The habitues of this part of the ship generally spend a great part of the day and night smoking, drinking, betting on the progress of the vessel, and in giving their views on how the officers perform their duties. The smoking-room of an ocean steamer has always reminded me strongly of the room where brakemen spend their time between runs. A brakemen's room is the place to hear emphatic views as to the ability and policy of the management. There the talk is of a character that would lead a novice to believe that brakemen were the bosom friends and confidents of presidents, and that their council and advice were asked before any new movements were undertaken. The men who frequent the smoking-room of a steamer talk as if they could give points on navigation to the captain, and they would lead those who did not understand them to believe that the chief engineer was liable to consult them if any difficulty arose. But, then, men with nothing else to do must use the safety valve between their jaws.

The mention of jaws reminds me of the amount of amusement some people enjoy on shipboard by keeping their jaws at work on masticating duty—that is, when they are not distending them to throw into the ocean articles of food which could find no secure hold inside the stomach. On the first day out I amused myself by passing four sessions at the table, but a silent voice admonished me to go slow, and I took the hint. Perhaps I obeyed Nature's laws more readily on account of the doings of a neighbor who furnished an awful example.

This man was dressed in clerical garb, and was demonstrative and loud in letting all and sundry understand that he was the Rev. Something of a well-known Episcopal church in New York. His face was suffused with the hue of the peony rose, and his nose resembled a well-cooked beet of generous proportions.

I was not drawn towards this man, yet his appearance and actions called up tender memories of my boyhood in connection with a character of my native village, who had a decided resemblance to this divine. This character was called John Murray, and he was the warmest-hearted man in the Mearns, no matter if the wine which is red enriched his blood and painted his nose. We boys had a nickname for him, suggested by the appearance of his proboscis.

John Murray was visiting a friend's house one day, and the friend had a bright little lassie, who came in with her mother. John began to joke with the child, and pretended that she did not know him.

"Oh, I ken ye verra weel," protested the child, in answer to his joking.

"You don't know my name, anyhow?"

"Oh, yes, I do. Your name is John Murray Strawberry Nose."

Our reverend member had so much of my old townsman's appearance that I got watching his actions, which I could very readily do, since he was in the next stateroom to me. Ship builders do not waste much energy in providing means to confine sounds to the staterooms they originate in, and consequently an inquisitive person can learn a good deal about the affairs of his neighbors. On the first night, about the hour of retiring, the Rev. Something gave emphatic injunctions to his mild and meek partner to get him up in time for the first breakfast. "You know, my love," he added, "I never feel well on shipboard unless I take my meals regularly."

He was up at 7 A. M., and I had ocular demonstration that he stuffed himself with "coffee and milk," as the French have it, with a generous padding of eggs, etc. At 9.30 he was at the table taking in the regular substantial breakfast, which rates up like a heavy luncheon. At 1 P. M. he was at table devouring regular luncheon. By industrious stuffing at this meal he contrived to hold out till 5.30, when the regular seven-course dinner was served. After getting through with the dinner, the Rev. loitered pensively around until 9.30, when he was invariably the first man in at the supper table. Then he went to bed and snored like a Daniel's planer suffering from asthma.

What first attracted my attention to this Rev. was a loud remark he made to the effect that he never drank anything but champagne. He was a good representative of high living on shipboard, but I noticed when he was ordering beverages in the sanctity and seclusion of his stateroom that Milwaukee was his favorite drink. I am not posted about champagnes, but I hardly think that any noted brand bears the name of "Milwaukee," and Wisconsin is not celebrated as a grape-raising State.

When we were about five days out the waves from some storm that did not reach us began to rock the ship. Rocking in the cradle of the deep is very poetical to people ashore, but to many poor sinners on shipboard it is worse than anything that has been related about purgatory. Understand that I am perfectly disinterested as to the condition of the weather or the waves, but when these particular waves were disporting themselves on our bow, beams, keel and stern I was wakened one night by unearthly sounds. I had several times listened to the coughings of the father rhinoceros in Central Park, and I thought at first that I was reposing near the shades of New York's own menagerie. But as the cloud of sleep cleared off my mind, I discovered that the unearthly noises proceeded from the adjoining chamber, and that they were the audible wrestlings of the Rev. in some efforts he was making to turn himself inside out

After a particularly noisy spasm the wife was heard asking, "Does it hurt you, Algernon, dear?" "Hurt!" he groaned. "Perhaps you think I am doing this for fun. I believe there is nothing left of my anatomy except the walls."

Sea sickness is agonizing, but, like toothache, its victims receive little sympathy because it is seldom fatal. It is curious to watch the actions of different people under the infliction. When the first symptoms appear women, and men, too, for that matter, will retire to the secrecy of their rooms to hide the contortions their faces undergo while trying to invert the processes of nature. But after a day or two, when the advantages of breathing the fresh air of the upper deck are understood, they will hold to the rail and go through all the movements regardless of who is looking on. Some of the expressions heard from sea-sick people are rather moving. Mrs. William Smith, of the Chicago and Northwestern, was crossing and had a sister along. The latter soon began to empty herself After she had hung over the basin for a long time the sister asked sympathetically, "Mona, do you think you are done now " "Well," said Mona, looking at the basin, "I ought to be empty, for that looks as if I had swallowed a cow "

Some people are not so ready to give out what they have swallowed. Some countrymen of mine were enjoying themselves on the first day out, and suddenly one of them began to show symptoms of sickness. He held his hand on his mouth, determined to hold on to what he had got. "Let it out, Sandy," said one of his companions, "and you will feel better." "Na, na," groaned Sandy, "I winna lat it up. Why, man, it's whisky!"

But the propeller keeps up its industrial tune. The season of sickness wears past. People come on deck who have not appeared since the morning of the first day, and longing looks are searching for the coast of Cornwall. The Lizard lighthouse creeps up from the horizon, the outline of welcome land appears. After signaling her arrival in European waters, the vessel veers towards the east, and we are presently in the open sea again, but a few hours brings us to the coast of France. After steaming up through picturesque islands and occasionally sighting the rock-bound coast, we reach the estuary where the river Seine pours its waters into the sea. We approach the city of Havre, finely situated on the sides of a bold promontory, and our voyage is ended.

A. S.

A Cannon for Shooting Out Tight Frame Bolts.

At the Erie shops—ay, Erie shops, for all have them now—can be seen a unique tool for taking out tight bolts. It does its work very quickly and efficiently, has but one moving part and its motive power is powder

The engraving shown here will make its construction plain.

The one the writer saw was made of a crank-pin and cost but a few dollars.

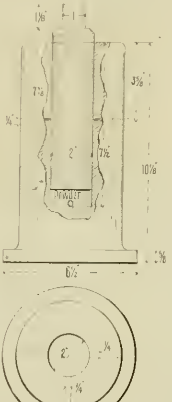
The cannon sets up on its breech, has a touch-hole at the bottom of bore and a ¼-inch hole bored across both sides part way up, as shown. This is a vent and serves another purpose described later. The 2-inch plunger fits the bore of gun and has a head reduced to 1 inch

In practice the gun is loaded with one-half ounce of powder and a short fuse is placed in the touch-hole. The plunger is raised up and a ¼-inch rod shoved through the holes under it for support, then the cannon is blocked up under the bolt to be struck just so that the top touches the bolt fair. Then the rod is removed and the plunger dropped back onto the powder, the fuse lighted, the workmen step back, and—there you are.

It has never failed to get out the worst bolt yet found

Some cylinder bolts 16 inches long, worn and rusted fast, that refused to be coaxed by any known plan, jumped up 5 inches when the gun went off.

It is said this tool was first introduced in this country at the Susquehanna shops of the Erie by a Frenchman who had used them in France

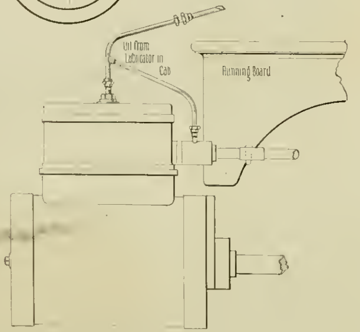


They are a first-class thing anyhow, and every railroad repair shop should have one. They cost less than the drilling out of one set of frame bolts.

A Sensible Way to Oil Metallic Packing.

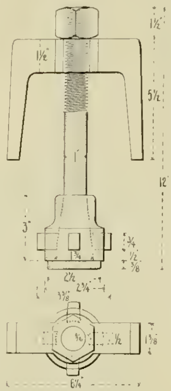
Every master mechanic who has the care of engines using metallic packing will agree that their freedom from grief depends on the efficiency of the oiling devices that keep the rod or stem well lubricated

Master Mechanic H. A Childs, of the Erie, having the usual amount of trouble, tried the experiment of tapping the packing ring case and running a small pipe from there to the lubricator pipe, as shown in our sketch.



This insures oil in the right place, and a good quality of oil, if the stem gets too much the surplus simply goes to the valve and cylinder, where it does some good instead of being wasted outside, as with swab cups.

A switching engine has been at work in the yards in Jersey City for some months with her valve stems so lubricated. The results have been so good that Mr. Childs has taken steps to apply it to the pistons, and to protect his invention.



A Nozzle Puller.

Boilermakers and roundhouse repair men who have wasted much time and patience trying to get a set of nozzles out of the ordinary stand will appreciate the little kink shown here, the invention of Master Mechanic H A. Childs, of the Erie shops at Jersey City.

The expanding jaws are slipped inside the nozzle and the taper bolt drawn up, thus forcing them open and taking a grip on the nozzle. The yoke is then slipped over the bolt and a nut put on. A few turns will persuade the most stubborn nozzle to "lave go her holdt."

Quality of Service More Important than Wages.

During the time the Traveling Engineers' Convention was in session at Denver, Col., President Jeffery, of the Denver & Rio Grande, gave an interesting address. Mr. Jeffery rose through the mechanical department, and naturally is very familiar with the work done by the traveling engineers. Among other good things he said

"I know that the general conception of a president is a man who can command results No greater mistake ever dwelt in the minds of men. It is one thing to earn money and another to expend it judiciously and honestly, and a railway spends its money through every employé on its pay rolls. I have come to the conclusion that the wage question is not so important as honest, capable, faithful and reliable service. A careless engineer can lose for his company thousands of dollars yearly on his engine, and it takes the most careful, painstaking scrutiny to discover the loss.

"I see by the papers that you have a committee for the purpose of studying the most economical use of coal. Suppose the cost of the coal consumed is $100,000,000. A saving of 1 per cent. is a saving of $1,000,000 Not saved by economy of physical exertion, but by brain power It is the same with oil and with all other supplies. This is to the end that the corporation being loyally served is benefited thereby. The reason I speak of this subject is that, considering the loss in revenue, the wage question may remain undisturbed. You will have interesting questions to solve and you will be happy in solving them. I remember that when I was a boy one of my happiest moments was when I found out how the steam got into the cylinder of an engine, and this was equaled a few weeks later when I found how it got out again."

Electric Motors for Machine Shops.

Among recent inprovements carried out in the Baldwin Locomotive Works was the removing of all overhead shafting from the wheel shop, and the providing of each machine with an electric motor for transmission of the motive power. The improvement has greatly increased the output of work and has materially reduced the power required for operating the machines. Mr. Vauclain estimates from the reduced coal consumption, due to the change from shafting and belting to electric motors, that the saving in power is about 40 per cent. A very important advantage enjoyed by the change is keeping the space above the machines perfectly clear of obstruction. A traveling overhead crane has been put in, which takes the work to and from the different machines, saving a great deal of time and manual labor. The electric motors used were invented by Mr. George Gibbs, of the Chicago, Milwaukee & St. Paul, and are particularly well adapted for the work They are substantial machines, that have the appearance of being designed by a man who understood the importance of producing an apparatus that would go on doing its work for months without having to stop for repairs. This is a characteristic that many electric motors sadly lack, and it has prevented this kind of a motor from attaining the popularity which its convenience deserves.

In the admirable report submitted to the last Master Mechanics' Convention on "Special Shop Tools," attention was directed to electricity as a means of transmitting power, but the committee were constrained to say that they had found very little progress made in utilizing electricity in locomotive repair shops. Owing to the success achieved in operating heavy cranes and other machinery by electricity, the committee recommended members who contemplated the erection of new shops or extension of old ones to investigate the possibilities of a good electric plant for the transmission of power. If the chairman of that committee could have examined the electric motors driving the heavy tools in the Baldwin Locomotive Works, or the same class of motors transmitting the power to tools in the Juniata shops of the Pennsylvania Railroad, we feel certain that the recommendations in favor of this system would have been much more emphatic. After a careful investigation of the merits of electric motors for driving machinery, the Illinois Steel Company lately applied these motors to perform a great variety of operations in the rolling mills at Joliet.

We believe that it would pay nearly every railroad company in the country, where electric connections could be obtained, to run by electric motors their wheel lathes and other tools that have to be worked frequently at night. There is nothing more common than to see a large engine toiling away all night operating whole lines of shafting in order to drive a wheel lathe or a planer that has to be kept busy on emergency work. It is like a locomotive being sent out to pull a hand car, with twenty flats in front to steady the load. We feel sure that the knowledge that improved methods are available is all that is necessary to induce nearly all the men interested to look into the merits of the electric motor. The electric motor has been applied with great success to all purposes for which flexible shafts have been employed, and it is much more convenient because it can be applied directly to the machine without the intervention of belts, and the objectionable rigging that often has to be used with the flexible shaft. Air has been very serviceable in operating special machinery used to facilitate repairs, but we believe that the electric motor is destined in the near future to take the place of many air-driven appliances.

Children's Questions About Our Pictures.

"Locomotive Engineering is costing me a great deal of time and gives me no end of bother," remarked President Vreeland, of the Metropolitan Railroads, the other evening at the club, "and I guess," he continued, "I shall have to give it up."

The scribe was slightly alarmed and anxiously demanded particulars.

"Well, it's this way," continued our genial friend. "I am in the habit of taking the paper home with me, and I have a small boy and a smaller girl at home who would rather look at the pictures in Locomotive Engineering than go to bed. They study the pictures in the day time and have all sorts of embarrassing questions to ask me about them when I come home. You see, I am not a locomotive expert like Millen there, and the youngsters are always firing questions at me which I cannot answer.

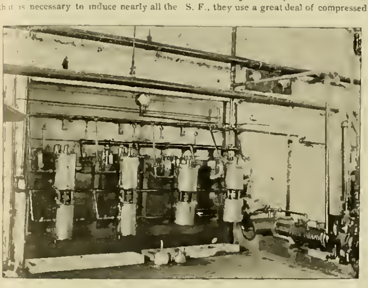
"Your last paper gave them great enjoyment, and of course gave me an equal proportion of embarrassment. That picture of a boiler with a man standing in the smokebox seemed a wonderful thing. What does the man do inside the boiler? Is there always a man kept inside? Open the door of that other engine and let us see if there is a man inside. These were specimen questions, and then they went for the picture showing the engine cab. I was expected to tell what every attachment was for, which I could not do.

"Then came your 'ignorance exterminator.' What are all these things in the picture? 'An ignorance exterminator.' What is that? A thing that lets people know things, did you say? But how does it work?

"Every page was gone over, and it was expected that papa could tell what every picture was. Then they would go over the paper again next day and find out more puzzling questions. I must either stop the paper or leave it in the office."

Pump Plant of the A. T. & S. F. Shop at La Junta, Col.

At the La Junta shops, of the A. T. & S. F., they use a great deal of compressed air, having a main reservoir containing 120,000 cubic inches.



Pump Plant, La Junta, Col. Shops, A. T. & S. F.

General Foreman M. J. Drury knew well enough that an ordinary air pump was a very wasteful compressor for shop purposes and he arranged to do the best he could with the means at hand.

He took an old Drane water pump out of the scrap and, removing the water cylinders, put on an ordinary freight car cylinder with a piston to fit, arranged the valves to handle air and the discharge was piped into an ordinary auxiliary reservoir. Into this same reservoir the two long stroke pumps, shown in picture, also deliver, and from the reservoir the two 8-inch pumps take the air further compress it up to the necessary 70 pounds and deliver it to the main reservoir.

The pump nearest the right is connected up by hose, this place being the test position for new pumps. The hose connections are used to facilitate handling. The lower connection is hinged, and the upper one consists merely of keys in studs to hold pump up. By removing these keys the pump drops forward and rests on the floor, where it can be relieved from lower fastening. One man can take down one pump and put up another.

Stock-Killing Lore.

One of the divisions of the S. P. R. R. has enrolled among its engineers an old German known as "Old Dutch." One day he ran over and killed a number of hogs, and failing to make out a stock report, was notified a number of times and finally ordered to report at headquarters. The superintendent asked him why he did not make out a stock report, to which he replied "I kill no stock." But said the superintendent "You did kill the stock, and I want a report." "No, I no kill some stock," persisted Old Dutch. "But I say you did," repeated the superintendent, "and have proof of it."

"Vat kind stock you call him?" asked our German friend. "Why, hogs," said the superintendent. "Oh," replied Old Dutch, "dot ish not stock—dose is insects."

On another occasion, after killing a horse, he commenced a vigorous tooting of the whistle, whereupon his fireman asked "What are you whistling now for? You killed that horse, way back there." "Yah," said Old Dutch, "but dose beoples a'round't here dondt know dot!"

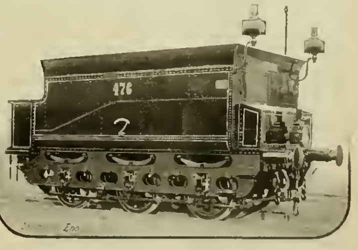
Train Wreck in Silesia.

Utilizing the Energies of a Burglar.

There is a night fireman and watchman with the Menlo Park Manufacturing Co. at Metuchen, N. J., who has a keen sense of practical humor. This man was attending to his duties one night when he heard some one opening the scuttle on the top of the boiler house, and presently a would-be burglar dropped into the stokehole. The watchman had a revolver ready for the intruder, and the first performance was to compel the man to hold up his hands, which he readily did on sight of the six-shooter. Presently the fires had to be attended to, and the fireman compelled the burglar to handle the scoop and keep the necessary supply of coal in the furnaces. That seemed to work well, so the fireman concluded that he might as well make the best of his unexpected help. The ash-pits would soon need cleaning, so the burglar was made to do that. Then there was some polishing in arrears, so he was directed to do that, and the margin of his time was utilized in wheeling coal from a distant part of the boiler house.

There are few people who travel much on railroad trains that have not had narrow escapes from accidents that they happily knew nothing about. This is a case where ignorance is decidedly bliss. Of all the close calls we have ever heard about, that experienced by the passengers on a train on the Philadelphia, Wilmington & Baltimore last month was about the most awe-inspiring. There is a private railroad crossing on the line. A large wagon containing a ton of smokeless powder while on this crossing was struck by the engine of a passenger train. The vehicle was hurled a distance of about twenty-five feet. Two of the horses broke loose and ran away the other two were thrown down an embankment and the driver was badly injured. If that ton of powder had exploded there would have been nothing but fragments left of train and passengers.

Those familiar with the writings of Shakespeare will remember the weird scene in "Macbeth," where a witch stirs the ambitions of the King's general with the prophecy, "Thou shalt be Thane of Cawdor," intimating thereby that he was on his way to the supreme position of King of Scotland. It is common in some parts of England to tell an industrious man "Thou shalt be Thane of Cawdor." During a recent election for presidents of a well-known railroad company a friend of the man elected vice-president, waxing poetical wired, "Thou art Thane of Cawdor." The fortunate candidate for the high office imagined that his friend must have got drunk, for when he received the message it read, "Thou art clam of chowder."



Tender of Kaiser Ferdinand Railway of Austria.

LOCOMOTIVE ENGINEERING
A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER and ROLLING STOCK

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Notice.

We have less than 100 copies each of January, February and June of this year. When these are gone back numbers for 1894 will be *out of print*. Don't blame us and say we didn't tell you in time.

SINCLAIR & HILL.

For 1895.

The American people know a good thing when they see it, and are willing to pay a fair price for it. We have found that the more money we spent in making LOCOMOTIVE ENGINEERING better, the more $2 bills people sent in.

This paper is purely a mechanical one, its mission in life is to *teach*, to keep men in the mechanical departments of railroads posted, it is no good for anything else, but in this line it is unique and stands alone.

Last year we gave our readers their money's worth in the paper, and also gave three Educational Charts. One of these, Chart No. 2, is now framed in thousands of railroad offices and homes throughout the world—*12,000 have been printed and sold*—and still there is a demand for it from every corner of the globe.

We have now employed regularly the artist who made the picture of the famous "999," and he will have charge of all our illustrations in the future.

During the year we shall issue a chart, for framing, by Mr. Donnell, that will be in itself a complete dictionary of the sleeping car and of the passenger coach,—such a picture in the car line as the "999" picture was of a locomotive.

Another fine picture for framing will be a beautiful colored plate of a modern, heavy 10-wheeled passenger locomotive. This will be the finest locomotive picture ever turned out by any one.

Beside the two pictures we will send each subscriber for one year a copy of a little book entitled "A Uniform Method of Examining Firemen for Promotion and Engineers for Employment." This is the plan just adopted (September, 1894) as standard by the Traveling Engineers' Association, and is one that every fireman and engineer wants. It has in it the standard blank form of application for position, and the forms of standard test for color blindness. This little book contains the questions proposed to be asked in all future examinations, and is one more educational extra given by LOCOMOTIVE ENGINEERING to its readers. We intend to keep up this sort of thing until the very fact that a man is a regular reader of this paper will be a certificate of horse sense in his business.

Our club-raisers will offer the above additions to the paper for 1895, not forgetting that the greatest of all *extras* will be the extra fine engravings and subject matter to be found in the pages of the paper itself.

To Our Advertisers.

We have come to the conclusion that advertising will not pay you—provided your competitors do it all.

Advertising is a fine art, and the average business man makes a bad job of it—they all know more about their business than they know about properly advertising it.

Large general advertisers employ experts to write and arrange their ads., but as none of our customers seemed likely to do this we have employed the expert ourselves.

Mr. Clarence P. Day will hereafter have charge of our advertising columns. He will suggest ideas and help you arrange and change your advertising in an effective manner—make it worth something to you.

We have also employed regularly an artist, Mr. A. L. Donnell, who will also aid our advertisers—he will make a good engraving for the ad of every yearly order *free*. His main object in being alive, however, will be to make the engravings in the reading columns of LOCOMOTIVE ENGINEERING better and provide more of them.

Maybe these extra artists are expensive luxuries for these times, but we think we know what we are doing. We intend that from this on to the end of the chapter, our contemporaries—to use a Bowery expression—"dey won't be in it wid us. See?"

If you want the services of either one of these artists just say the word—they are yours.

Frictional Resistance and Brake Efficiency.

The republication by the Westinghouse Air Brake Company of papers read by Captain Douglas Galton at meetings of the Institution of Mechanical Engineers, in 1878, on "Effects of Brakes Upon Railway Trains," has revived the interest in a subject which is of absorbing interest to railway men. A study of the paper in the first place impresses us with the inaccuracy of what were formerly accepted as absolute laws relating to frictional resistances. Turning our mental vision to the same laws as propounded to-day, we are inclined to conclude that they are to a great extent guesses, with little claim to scientific accuracy.

The laws of friction as formulated in the text-books are supposed by many people to be as invariable as the laws of gravitation, and are accepted as being equally correct. Unless it be the accepted laws relating to the resistance of trains, we do not suppose that scientific laws were ever established on more insufficient data than those on which a pretentious system of rules respecting frictional resistance was built up—rules which are still to be found in nearly all engineering text-books. There is a certain class of so-called scientists who are always attempting to establish laws on any natural phenomena which seem to repeat themselves, and they do not have the caution or patience to prove whether or not they are right before going ahead. This has led to an amazing amount of misrepresentation. Fallacies have been declared to be principles and half-truths have been declared to be immutable laws.

No attempts of any consequence were made until 1831 to establish rules relating to frictional resistance of bodies rolling over or rubbing upon each other. About that time General Morin of the French army conducted a series of experiments on frictional resistance of different bodies on which he enunciated three fundamental laws of friction. These "laws" were 1st, Friction between two bodies is directly proportioned to the pressure; that is, that the co-efficient is constant for all pressures. It meant, for instance, that when a weight of 4,000 pounds was placed upon a journal the resistance of motion would be exactly double what it would be when the weight was 2,000 pounds. The second law says that the co-efficient and amount of friction pressure being the same, is independent of the areas in contact. The third law holds that the co-efficient of friction is independent of velocity, although static friction or resistance to start is greater than the friction of motion.

Gen. Morin probably found these rules to be fairly correct under ordinary conditions, but they were not strictly accurate, and were therefore not entitled to be considered as laws. Yet their author considered that he had discovered some new laws of nature, and proclaimed them to the world.

There was nothing very strange in the fact that Morin considered acts which repeated themselves under the same circumstances as being likely to produce results of the same proportions under all conditions. We have seen the same thing happen scores of times with men who made experiments with locomotives. A certain valve or smokestack or exhaust nozzle arrangement would be reported upon as superior to everything else and uniform in the results produced and worthy to be offered for universal practice, when it was merely superior to others for the particular conditions it had to meet.

There is nothing more curious in the history of scientific delusions than the confiding faith with which Morin's doctrines were accepted by the men whose duty it was to investigate and prove before accepting the new theories as gospel. We never heard of the least murmur of doubt. The author of the friction theories was a positive man, with abiding faith in himself, and he carried along the whole world through his magnetic personality. The first man to throw doubt on Morin's laws was Prof. Thurston, now of Sibley College, Ithaca, N. Y. While professor of mechanical engineering in Stevens Institute of Technology, he engaged in an extensive series of tests of oils, and by implication of the frictional resistance of lubricated surfaces. These tests demonstrated beyond question that under ordinary circumstances a journal carrying a load of 4,000 pounds did not offer double the frictional resistance that was offered by a journal carrying 2,000 pounds. This discovery was corroborated by experiments made with dynamometers by the mechanical department of the Pennsylvania Railroad and of the C., B. & Q. Railroad, also by independent experiments carried out by Mr. A. M. Wellington in Cleveland. It was proved that the axial resistance of a loaded car was only about 4 pounds per ton, while the resistance of an empty car was about 6 pounds to the ton. The first practical result of this discovery was the readjustment of locomotive loads by all the railroad companies whose officers had kept themselves informed on the progress of knowledge. Guided by the Morin law, it used to be considered proper to load an engine with the same tonnage of empties as the engine could pull of loaded cars. The new light showed that two-thirds of the weight made a train equally hard to pull.

Before the correct law of frictional resistance of lubricated surfaces was properly understood we have frequently heard intelligent enginemen arguing that they could not haul the same weight of empties as of loaded cars up a hill. They were generally classed as cranks or kickers.

An important principle deduced from the first of Morin's laws was that the resistance of a brake shoe or of any other unlubricated surface was constant, no matter what the speed might be. This was implicitly believed to be correct until the Galton-Westinghouse experiments with railway brakes were carried out. At a meeting of the Institution of Mechanical Engineers held in London in 1878, Mr. George Westinghouse, Jr., called attention to the fact that in testing the action of various kinds of brake shoes, he observed a remarkable difference in the friction of shoes upon the wheels at high and low speeds. He offered to construct an apparatus to ascertain if the friction of brake shoes varied at different speeds, if the Institution would appoint any person to supervise the tests. Captain Douglas Galton was appointed and data was obtained which proved that Morin's first law was no law at all. It was shown that the co-efficient of friction (resisting forces) between the brake shoe and the wheel, diminished as the speed was increased. The co-efficient of friction seemed to be controlled by a law for it diminished regularly as the speed increased, and *vice versa*. Heating of the shoes increased the frictional resistance. Particulars about the discoveries made in these experiments are very fully described in the publication mentioned at the beginning of the paper.

The lessons of the experiments were that brakes should be designed for fast trains in such a way that the shoes could be pressed upon the wheels with a force to suit the speed of the revolving wheel. This has lately found practical application in the reinforced brakes that have been tried on some fast passenger trains. As railroad men come to a realizing sense of the difference in the resisting force of brake shoes at low and high speeds, they will be more and more inclined to make use of a brake with a high ratio of efficiency and capable of adjustment to suit the speed. The frictional resistance of brake shoes at 20 miles an hour is about double what it is at 60 miles an hour. A fact of this kind cannot be too widely known.

One important thing concerning the action of brake shoes was unfortunately not demonstrated in the Galton-Westinghouse experiments. This was the relation between extent of surface and resisting power. There is some conflict of opinion among experimentors as to whether a large or a small brake shoe holds best, and it is very desirable that the question should be settled beyond dispute. Certain experiments carefully conducted have appeared to show that a generous bearing surface produces the best braking effects, while others equally well conducted have shown quite the reverse. It is quite conceivable that a brake shoe lightly applied might be too large to produce in a high degree the locking action of surfaces which causes friction. On the other hand, a shoe might be so small that its effect was similar to a wheel when it slides. There is a committee of the Master Car Builders' Association engaged making laboratory tests of metal for brake shoes which may be able to present accurate information that will be of great value to the whole engineering world. More knowledge is certainly needed about metal for brake shoes. It would be directly in the same line to investigate the most suitable area of metal for doing the most effective braking. Many particulars relating to the laws of frictional resistance have yet to be elucidated.

Inferior Boiler Tubes.

The investigations carried out by the railroad mechanical associations and by railroad clubs have left few details connected with railway machinery to be investigated and discussed. There is, however, one subject which seems to have received less attention than its importance deserves, that is the proper material for boiler tubes. The material best adapted for boiler and firebox has been thoroughly investigated and railroad men who do not understand what is likely to produce the most satisfactory results in these parts have not kept in touch with advanced knowledge respecting their business. The economical service obtained from a boiler is more dependent on the quality of the boiler tubes than it is on the quality of material in any other part; yet there is little attention bestowed upon seeing that the very best boiler tubes are specified.

There is an impression among many master mechanics that charcoal iron makes the best boiler tube, and they are inclined to specify that material, yet, in the majority of cases, something less reliable is supplied. Charcoal iron is not a cheap material, and the advocates of cheapness very often get in their work to substitute steel for the better material. In many departments of the mechanic arts steel is a material more suitable and reliable than iron, but for boiler tubes this is an emphatic exception. When mild steel tubes are first applied they may do very well until the time comes when calking or rolling is required. The action of the calking tool or roller hardens the steel to the extent that it is almost impossible to force the material to maintain a water-tight fit. The result is constant leakage. We know of nothing more calculated to waste fuel so persistently as leaky tubes. There are honest differences of opinion about many things connected with locomotive operating but we never found a locomotive man, from fireman to superintendent of machinery, who did not agree that leaky tubes was about the worst evil from which a locomotive could suffer. We believe that the cheap inferior steel tubes imposed upon railroad companies is responsible for much of the expense, delay and annoyance that railroads suffer from on account of leaky tubes.

We use the expression imposed upon railroad companies advisedly, for we believe that many purchasing agents accept steel tubes under the impression that they are made of good iron. A representative case may be given. A railroad company ordering new locomotives specified charcoal iron tubes. The various tube makers submitted their bids, and one was away beneath the others in price. He offered to supply the maker's best brand, N. G. The purchasing agent concluded that the cheap tubes must be something superlatively fine from the high-sounding title, and is inclined to give the order to the lowest bidder. But before closing he happens to mention to one of the other tube men that he is not in it, owing to price, and tells that the best brand—N. G.—is going to carry away the order. "But that is not a charcoal iron tube," protests the other, "it is steel." "Oh, no," says the purchasing agent, "charcoal iron is specified, and this is best brand N. G. of charcoal iron." The other knew better and maintained his point so strongly that the P. A. made up his mind to investigate further. The N. G. man was called in again and questioned if his tube was charcoal iron. "Our tube is best brand N. G., the best tube in the market, except our special brands," was the answer given. "But is best brand N. G. made of charcoal iron?" insisted the P. A. Well, the agent was not certain about the chemical composition of the tubes, but he was certain that they were first-class. When the matter was pressed still further it came out that the tubes were steel. This vague talk about some high-sounding brand imposes inferior steel tubes upon many people who think they are getting the best in the market.

A case is within our knowledge where a railroad that was not getting by any means good feed water went along for years with less trouble from leaky tubes than any road in the same region. The head of the mechanical department had very sound views about material for tubes, and always ordered good charcoal iron, and was careful to see that he got what he ordered. In the course of time a concern on the line of the road began the manufacture of boiler tubes, and the initiated were aware that high officers of the railroad company had stock in the tube-making concern. The cheapest kind of steel tubes were made, but the superintendent of machinery was given to understand that it was necessary to patronize local industries, and that all boiler tubes must be purchased from the new concern. The result was that the road became notorious for the delays of locomotives, due to leaky tubes, and the change is today costing that railroad company many thousands of dollars extra every year on account of the waste of fuel due to leaky tubes. In addition to this, the system is harassed by the constant demoralization of the train service due to delays which are attributable to leaky tubes.

A committee has been appointed by the Railway Master Mechanics' Association to investigate and report on the "Best Materials for Boiler Tubes and Specifications for Same." The investigation is in the hands of an excellent committee, and we have no doubt but valuable information will be submitted in the report. There are now standard specifications for boiler steel, and there is every reason why there should be added to the list specifications for boiler tubes. It would prevent a great deal of deception, not to say fraud.

A correspondent in another column makes some very timely and practical suggestions concerning the danger of making mistakes between the ordinary figures and the full-face figures used on time cards, and in the figures themselves. When a time card becomes soiled or when it is folded on the figures, it is frequently difficult to distinguish one figure from another. This is a source of danger which ought not to exist when there is a simple and highly practical remedy. Time cards are consulted by engineers at night under very difficult circumstances, and every care should be taken to help them in reading correctly. The remedy proposed to make the two sorts of figures more distinctly different is to use script figures in place of the full-face. The script is a thin figure of different shape from the Arabic figure in common use. It is so distinctive in shape and line that there never would be any danger of mistaking it for an Arabic figure, and a *9* and a *6* are distinctly different. A change of this kind could be made so easily that we can see no good reason why it should not be carried out. We cordially urge the attention to this important matter on all those who have the arranging of time tables.

Secretary Cloud, of the Master Car Builders' Association, has issued a circular saying that the Executive Committee have not been able to arrange for the making of the standard gauges of the Association, because a sufficient number of railroad companies could not be induced to order the gauges. They considered the prices quoted by makers of gauges to be too high. Railroad companies are therefore recommended to make their own gauges, but they are urged to use the lithograph drawings of the Association to take dimensions from. These drawings ought to be in every railroad drawing office where car work is done.

BOOK NOTICES.

ELEMENTARY LESSONS IN HEAT. By S. E. Tillman, Professor of Chemistry, United States Military Academy. John Wiley & Sons, New York.

This is the second edition, revised and enlarged, of a useful book treating on a subject which is of great value and interest to all students of physical science. As all mechanical operations are closely associated with heat manifestations, a book which makes these varied manifestations clear to the student is certain to be valuable. The author in this treatise has endeavored to give a clear and concise explanation of the leading phenomena of heat as enunciated in a variety of philosophical works and text books. He has effected his purpose in a manner which ought to be satisfactory to those most interested. The subject is treated under eleven headings or chapters, with a great variety of sub headings. The scope of the book may be fairly judged from the names of the chapters, which are: Thermometry, Dilatation of Bodies, Calorimetry, Production and Condensation of Vapor, Change of State; By Geometry; Conduction; Radiation, Thermo-Dynamics, Terrestrial Temperature, Aerial Meteors; Aqueous Meteors. To the engineer the first nine chapters are of the greatest importance, and they constitute a good text book on heat. Those interested in weather phenomena will find the last two chapters interesting and instructive.

PERSONAL.

Mr. J. R. Bissett has been appointed foreman of the shops of the Atlantic Coast Line at Rocky Mount, Va.

Mr. W. B. Poland has been appointed assistant chief engineer of the Cleveland, Cincinnati, Chicago & St. Louis at Cincinnati, O.

Mr. B. A. Cunningham has been appointed division engineer of the Lehigh Valley between Manchester and Wilkes-barre, Pa.

Mr. J. H. Simpson has been appointed assistant to the general manager of the Flint & Pere Marquette, with headquarters at Saginaw, Mich.

Mr. S. J. Morris has resigned as general foreman of the Louisville & Nashville shops at New Orleans to accept a position on the Western of Alabama.

Mr. R. E. Riggs has been appointed chief engineer of the Mexico, Cuernavaca & Pacific. He was formerly chief engineer of the Denver & Rio Grande.

Mr. T. Carmody has resigned as master mechanic of the New York Pennsylvania & Ohio Division of the New York, Lake Erie & Western at Cleveland, O.

Mr. H. O. Burroughs has been appointed foreman of the shops of the Florida Central & Peninsular at Jacksonville, Fla., to succeed Mr. Charles G. Mann, transferred.

Mr. L. R. Brooks, of Birmingham, Ala., has been appointed superintendent of motive power of the New Orleans & Southern, with headquarters at New Orleans, La.

Mr. Walter Shepard, heretofore assistant chief engineer of the Boston & Albany, has been appointed chief engineer of that road, with headquarters at Boston, Mass.

A dispatch from Chihuahua, Mex., states that ex-Master Mechanic McKelvey, of the Iron Mountain Road at Little Rock, Ark., has been stabbed twenty-six times by a Mexican.

Mr. Thomas Crow has resigned as master mechanic of the New Orleans & Southern at New Orleans, La. to accept the position of chief engineer of the Belle View plantation.

Mr. S. R. Kramer has been appointed superintendent of the Peoria Division of the Lake Erie & Western, with headquarters at Lafayette, Ind., to succeed Mr. E. O. Grady, resigned.

Mr. F. D. Thompson has been appointed general superintendent of the Chesapeake, Ohio & Southwestern Railroad, with headquarters at the general offices of the receivers in Louisville, Ky.

Mr. George L. Bradbury, general manager of the Lake Erie & Western, has been chosen vice-president of the Cincinnati, Jackson & Mackinaw, in charge of the operation of the road.

Mr. H. E. Burt has been appointed general superintendent of the Minnesota & Wisconsin, in place of Mr. James Monogue, who was acting superintendent, headquarters, Spring Valley, Wis.

Mr. Wilbur Lee has been appointed general manager of the Oregon Railway & Navigation Co. He is a son of Mr. David Lee, engineer of maintenance of way of the Baltimore & Ohio Railroad.

Mr. F. F. Robb, superintendent of the Bedford division of the Pennsylvania Railroad, has been appointed superintendent of the Cambria & Clearfield division, with headquarters at Cresson, Pa.

Mr. T. F. De Garmo, president of the Railway Supply Men's Association, so well known to railroad men through his connection with the Trojan car coupler, has taken the management of the Burns' car coupler.

Mr. J. N. King has been appointed superintendent of the Philadelphia, Reading & New England, succeeding Mr. G. T. Royer. Mr. King was for some time a division superintendent of the Lehigh Valley.

Mr. J. H. Emmert, general manager's assistant of the Kansas City, Fort Scott & Memphis, has been appointed superintendent of the Springfield and Ozark division of that road, with headquarters at Springfield, Mo.

Mr. J. D. Begg, who has for a number of years been a machinist in the shops of the Columbus, Hocking Valley & Toledo at Columbus, O., has been appointed master mechanic of the Southern Pacific at Houston, Tex.

B. F. Pabst, traveling engineer of the Baldwin Locomotive Works, left New York on October 22d for Brazil. Will McCarroll is in Europe, and Chief Inspector Crawford in Japan. The Baldwin people are trade hustlers.

Mr. David M. Watt, for nearly thirteen years superintendent of the Monongahela division of the Pennsylvania Railroad, has been appointed superintendent of the West Pennsylvania division, with headquarters at Allegheny City, Pa.

Mr. H. B. Harper, trainmaster of terminals of the Chicago & Eastern Illinois at Danville Junction, Ill., has been appointed division superintendent of that road, in charge of the Brazil division, with headquarters at Brazil, Ind.

Mr. E. F. Weld, who some time ago resigned as purchasing agent of the Flint & Pere Marquette to go to the Southern Railway, has been appointed general storekeeper of the latter system, with headquarters at Richmond, Va.

Mr. James Reed, who has been superintendent of the West Pennsylvania division of the Pennsylvania Railroad since January, 1891, has resigned that position. He has been connected with the Pennsylvania system in various positions since 1872.

Mr. J. W. Gartside has been appointed roundhouse foreman of the Interoceanic, at Puebla, Mex., under Superintendent of Motive Power W. R. Barclay. Mr. Gartside learned his trade in Hornellsville, N. Y. Everyone is glad to see him climb the ladder to promotion.

Mr. R. D. Fowler, heretofore trainmaster of the Chicago & Eastern Illinois at Brazil, Ind., has been appointed division superintendent of that road, with headquarters at Danville, Ill., in charge of the main line, St. Louis division and Cissna, Rossville and Brazil branches.

We are informed by the Ajax Metal Co., Philadelphia, that Messrs. P. A. Lester & Co., Monadnock Building, Chicago, will in future represent all their products, including bearings metals, electrical supply department, roofing plates and all other articles manufactured by the Ajax Metal Co.

Mr. Willard A. Smith, so well known through the duties he performed as chief of the transportation department of the World's Fair, has been made vice-president of the National Malleable Castings Co., and will have charge of the railway sales department with headquarters in the Old Colony Building, Chicago.

Mr. Charles L. Sullivan has been appointed mechanical engineer of the railway department of the National Malleable

Castings Co., with headquarters Old Colony Building, Chicago. Mr. Sullivan was formerly engineer of tests of the Baltimore & Ohio Railroad, and was for a time with the Boyden Brake Co.

Mr. Walter G. Berg, principal assistant engineer of the Lehigh Valley Railroad, has been elected fourth vice-president of the American International Association of Railway Superintendents of Bridges and Buildings. Mr. Berg is author of a book on railroad buildings, and he is an excellent authority on coaling stations for railroad use.

Mr. S. C. Boutelle, a well known engineer, of Los Angeles, Cal., was on the first of September appointed master mechanic of the San Diego, Oldtown & Pacific Beach R. R. Bro. Boutelle is an old-time railroad man, having been for a number of years master mechanic of the California Southern. The S. D., O. & P. B. is to be congratulated in securing the services of so competent a man.

The jurisdiction of Mr. John Henney, Jr., superintendent of motive power of the New York, New Haven & Hartford system, has been extended to the Old Colony system, covering the duties formerly performed by J. N. Lauder. Mr. Henney has been with the New Haven Company for many years, having risen through successive grades to his present position. He is a highly conservative man, and is deservedly popular with his management.

The numerous friends of Mr. C. A. Moore, of Manning, Maxwell & Moore, will be concerned to hear that he met with a painful accident last month, which nearly ended his career. He was out riding in a carriage and the horses ran away, throwing out the occupants. The coachman was instantly killed, and Mr. Moore was badly shaken and sustained a painful injury to his side. His little daughter who was in the carriage with her father, escaped without injury.

Mr. Edmund S. Bowen, formerly assistant to the president of the New York & New England, has been appointed general manager of the South Carolina & Georgia, in charge of transportation and maintenance, with headquarters at Charleston, S. C. Mr. Bowen is a railroad manager of mature experience, and is known as one who has a particularly keen eye for restraining expenditures not absolutely essential. He was general manager of the Rome, Watertown & Ogdensburg when Mr. C. H. Parsons was in control.

Mr. W. D. Ewing, the enterprising general superintendent of the Fitchburg Railroad, is reported by the *Railway Age* to be striving to effect a reformation in the use of the locomotive whistle. He holds correctly that there is confusing diversity among engineers in sounding long and short whistles. Mr. Ewing is working to instruct the men how to gauge time in sounding the whistle. Many mistakes have been made by trainmen and others in misunderstanding whistle signals, and the subject is certainly worthy of more attention.

The numerous friends of Mr. Orlando Stewart, formerly superintendent of motive power of the Fitchburg Railroad, will be pleased to learn that he has been appointed superintendent of machinery of the Bangor & Aroostook, with headquarters at Oldtown, Me. Of course all his friends know that Mr. Stewart is treasurer of the Railway Master Mechanics' Association. Before going to the Fitchburg he had experience on the Lake Shore and other leading railroads, and was for a time in the employ of the Government in the South during the war.

Mr. Daniel Coxe, Supt. of the D. S. & S. road, was married on October 10th to Miss Margaret Brinton White, of Drifton, Pa. It was only a month ago that we heard a prominent railroad man say "Dannie Coxe is the youngest man designing locomotives in the country. He has ideas out of the usual and the courage of his convictions—he builds his engines the way he believes—and every idea advanced has proven a success in practice. He keeps out of the old ruts." And now "Dannie" Coxe goes and spoils it all by dropping into the old, old rut, and getting married, just like the rest of us. But here's long life to you and yours!

Mr. Willard Kells, for two years general foreman of the New York, Lake Erie & Western shops at Meadville, Pa., has been appointed master mechanic of the New York, Pennsylvania & Ohio division at Cleveland, Ohio, in charge of the shops at that point. Mr. Kells is a son of the late Ross Kells, formerly superintendent of motive power of the road. Willard was learning the machinist trade in the shops at Susquehanna, when his father died. He was the kind of youth that good men are made from, and was ambitious to render himself worthy of promotion. Mr. Mitchell took a warm interest in him and has given the young man the opportunity to help himself, and the good offices were not wasted. He made an excellent foreman, and that indicates that he will be a success as a master mechanic.

Mr. Henry S. Manning, of the firm of Manning, Maxwell & Moore, inherited a taste for art which he has cultivated until he is an authority in several art lines. He has a warm liking for fine wood carving, and some time ago he employed a famous artist to make designs for staircase and room carving decorations. They were very satisfactory, and Mr. Manning imagined that he had something unique. Last summer and winter he spent several months in Europe, and while there made a visit to Northern Africa to see the ruins of some ancient cities. There were excavations going on among the ruins and Mr. Manning thought he would like to try his hand on digging for relics. He did not dig long when he unearthed some fragments of marble work beautifully carved. When he examined it closely the designs looked familiar, and close examination convinced him that they were the same as some of the oak carvings in his house. He has been trying to get the artist to explain how it came that his designs were copied by the people who carved that marble.

Two Honored Engineers.

The authorities who confer honors in the French Republic appear to have a proper appreciation of the importance of engineering. During a recent visit to Paris, the writer met two superintendents of railway machinery who had been decorated with the Legion of Honor.

The first was Mr. George Whaley, of the Western Railway of France. Mr. Whaley was sent by his government as Commissioner to the Columbian Exposition, and while attending to the duties of this appointment, he spent several months in the United States. He visited our leading engineering and railroad establishments, and made many friends wherever he went. His name is English and he talks English without the least trace of French accent. He is surprisingly well informed on everything relating to railway engineering as it is seen in all parts of the world.

The other engineer who carried the decoration of the Legion of Honor was Mr. Eduard Sauvage, superintendent of machinery of the Eastern Railway of France. He is the author of a book on the locomotive, which is greatly used by enginemen in preparing for their examinations. Mr. Sauvage devoted the greater part of a day to showing the writer about his establishment. He is remarkably well informed concerning American railway practice and reads our engineering literature with much attention and interest.

John Wiley & Sons, New York, have in the press a new mechanical engineers' pocket-book, prepared by Mr. William Kent, a well-known member of the American Society of Mechanical Engineers.

Place For Next Railroad Mechanical Conventions.

The joint committee of the Master Car Builders' and Master Mechanics' Associations met at Chicago on October 6th to consider where the next convention should be held. A number of letters were read respecting the hotel accommodation that could be provided at Manitou and Colorado Springs. The committee concluded that the accommodation was not sufficient. Letters were also read from a variety of other places that wished to secure the conventions.

On an informal vote being taken it was found that most of the committee favored Thousand Islands, Alexandria Bay, N. Y. That place was selected. A committee of arrangements was appointed, consisting of S. A. Crone, R. C. Blackall, C. E. Fuller, Jr. This committee has sent out a circular intimating that arrangements have been made with the Crossmon House and the Thousand Islands House as joint headquarters. Parties who expect to attend the conventions ought to apply for rooms without delay.

At the Traveling Engineers' Convention there was inclination among some of the members present to hold that a fireman could not be instructed about brakes in the thorough way recommended by a committee. When the subject was under discussion Mr. R. D. Davis, of the Illinois Central, said: "I want to state an occurrence that happened in the air-brake instruction car the other day at Chicago. I had seven engineers in there, and one fireman asked if he could come in and listen. I said, 'Certainly.' I had instructed all those engineers, and then was asking them to trace the air through the chart I had on the side of the car, and there was not one that could commence to do it. After I had instructed them, I am sorry to say, they couldn't do it. This young man, this fireman, said, 'I would like to do that.' He got up there and traced the air through better than I could, I believe, that is, he could name every part and number better than I could. There was nothing when he got through that I could tell him. Others possibly could have told him, but I never saw a man in a car in my life that could trace the air through and explain the air brake and its workings better than that fireman. It was not three months after that when I had him on a locomotive, and he is running to-day and giving good satisfaction, and he learned it himself."

The American International Association of Railway Superintendents of Bridges and Buildings held the fourth annual meeting at Kansas City last month. President J. E. Wallace of the Wabash presided. Papers were read on "Best Methods of Bridge Inspection," on "Maintenance of Pile and Frame Trestles," on "The Best Scale Foundation," and on "Depressed Cinder Pits." All the papers were of a highly practical character. The meeting will be held next year at Atlanta, Ga. The officers elected were: President, Geo. W. Andrews, Baltimore & Ohio, Philadelphia. First Vice-President, W. A. McGonagle, Duluth & Iron Range, Two Harbors, Minn.; Second Vice-President, L. K. Spafford, Kansas City, Fort Scott & Memphis, Kansas City, Mo.; Third Vice-President, James Stannard, Wabash, Moberly, Mo., Fourth Vice-President, Walter G. Berg, Lehigh Valley, Jersey City, N. J., Secretary, S. F. Patterson, Concord & Montreal, Concord, N. H.; Treasurer, George M. Reid, Lake Shore & Michigan Southern, Cleveland, O.

The *Street Railway Journal* have made their tenth anniversary the occasion for issuing a special number containing an account of the Atlanta meeting of the American Street Railway Association. The number shows very great enterprise on the part of the owners of this publication. It contains a sixteen page article on Atlanta, a ten page article on the association, a thirty page article on the street railways of Southern cities and a twenty page article on the history of the street railway industry. All these are handsomely illustrated, containing over 400 engravings, among which are 125 portraits of leading street railway men. The number ought to be highly appreciated by all street railway interests.

A very interesting and valuable department has been inaugurated by the *Engineering Magazine*, called a "Review of the Industrial Press." Engineers and business men interested in industrial matters have generally so much to do that they cannot give the reading of industrial publications the time they would often like to devote to this line of reading, and consequently they often miss things that are important for their business. The plan adopted by the *Engineering Magazine* will prove a great boon to such men for it purposes to cull the fairest flowers of the industrial press and perform the functions for this kind of literature that the *Review of Reviews* does for the lighter lines of reading. We consider the enterprise a highly valuable one, and we have no doubt that it will meet the deserved appreciation.

The *Car Journal* has been made the official organ of the Master Car and Locomotive Painters' Association.

EQUIPMENT NOTES.

The Mexican Central are in the market for 200 cars.

The Swift Refrigerator Car Co. are about to order 200 cars.

The C. N. O. & T. P. are said to be in the market for 300 box cars.

Baldwin's people have just shipped a number of locomotives for Japan.

The Wells & French Co., of Chicago, are building 500 cars for Armour & Co.

The Mount Vernon Car Works are building 500 freight cars for the Louisville, Evansville & St. Louis.

The Niles Tool Works have lately shipped a large quantity of tools for the Boston & Albany shops and for the Georgia Central.

The Savannah, Florida & Western are in the market for the building of 100 refrigerator cars of a new form designed by President Plant.

The Southern Railway have ordered eight new engines. Five have gone to the Richmond Locomotive Works and three to Rhode Island.

The Southern Pacific has given out the building of forty-three new locomotives. Cooke's people received twenty of the engines, and the others went to Schenectady.

The proprietors of the "Official Railway Equipment Guide" have arranged to issue quarterly a pocket list of railroad officials. We have examined a specimen number and find that the names and addresses are correct and up to date. The fact of the publishing this book four times a year will add very materially to its value. Mr. J. Alexander Brown has charge of this new list.

The Consolidated Car Heating Co., Albany, N. Y., report that they have just received orders for the entire equipment of the Norfolk & Western Railway with its Commingler Storage System and Sewall steam coupler, also for the entire equipment of the Ulster & Delaware R. R. with its Direct Steam System No. 2 and the Sewall steam coupler. The orders include equipment of all locomotives on both these roads with the Consolidated improved locomotive equipment.

Practical Letters from Practical Men.

Facts Wanted. There's a glut of Opinions.

Write on one side of the paper, state your point plainly and briefly, and then quit. We supply the generalities. No letters noticed unless name and address are annexed.

Reform Needed in the Figures of the Time Cards.

Editors:

That a particular kind of type, often used in the printing of railroad time tables, is dangerous, may seem improbable to those who are responsible for the card, and possibly to everyone who consults it, except engineers and conductors. Those two classes of railroad men are responsible for every passenger and bit of freight that goes out on the road, and as this traffic represents the sole source of income to the railroad companies, and as engineers and conductors must correctly read and understand the time card in order to take their trains over the road safely, it is a matter of no little importance that the card should be printed in the figures easiest to read and easiest to identify in case of a partial erasure, or obliteration from soil or shade.

The regular time tables that I am acquainted with were issued for use on representative, first-class roads, but I am sure that if the officials who arranged them and were satisfied with the kind of type used had ever been locomotive engineers, the time card would not have been printed in Arabic numerals.

Studying a time table printed in Roman type from the seat box or foot plate of a locomotive in motion, is very trying to the eyes and brain of a man of perfect sight and in broad daylight. It isn't like sitting in the office with the paper spread out before you, without crease or stain, on a level table, in the steady light of day or the gas jets, when your eyes have time to follow your finger up and down the column until the right figure is found. An engineer's attention is diverted from the card several times before he finds what he wants to know, and then it's a glance, and he folds the card and shoves it down in his pocket. Trying to read a time card at night in the cab of a passenger engine running forty or fifty miles an hour, by the necessarily dim light of the cab lamp, the engine bounding, jolting and careening sideways and back, and the eyes temporarily blinded by the intermittent glare through the firebox door, is one of the hardest duties of an engineer, and excites nervousness even with old runners, for a correct reading of the time card is necessary to the safety of the train and every one in it including himself, and necessary in order that he may hold his position as engineer.

Arabic numerals are dangerous, because half of the figures look alike under certain conditions that easily and often occur. They have the same dimensions, height and width. The cipher and numerals 0 3 6 8 9, or in full face, to designate meeting points, **0 3 6 8 9**, fill the outlines of similar sized ellipses or ovals, and may, by the use of a sharp instrument, be partially effaced so that they appear as five ciphers, and grease or dirt may produce the same effect. I have seen time cards where the creases from folding made everyone of those five characters illegible where the creases crossed the sheet.

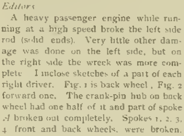
There is one style of figures that bear no resemblance toward each other whatever—the kind that is easiest to write and easiest to read—script. *1* [illegible] *7*, and after becoming accustomed to reading them on the time card, it would be impossible to mistake any one figure for another, or to fail to recognize the power of a character, unless it was almost entirely obliterated. Possibly there are roads that print their time-card figures in script. I have never seen such a card.

Terre Haute, Ind. WILL W. WOOD.

A Strange Wreck.

Editors:

A heavy passenger engine while running at a high speed broke the left side rod (solid ends). Very little other damage was done on the left side, but on the right side the wreck was more complete. I inclose sketches of a part of each right driver. Fig. 1 is back wheel, Fig. 2 forward one. The crank-pin hub on back wheel had one half of it and part of spoke *A* broken out completely. Spokes 1, 2, 3, 4 front and back wheels, were broken. Spokes *B C D E*, back wheel, each had a large piece broken out of the outside edge of the spoke. Forward crank pin hub was



broken through at the dotted lines. That part of the wheels not shown was uninjured. Fig. 3 is the right side rod with the back pin in it, the forward end of rod was on the forward pin, which remained in the wheel. The rod was bent about as shown, and with the holes in solid end somewhat elongated. Now what wrecked the right side and what broke the pieces out of the spokes? The back wheel was in a generally battered condition. I have a theory bearing on the subject, but what say the readers of this article? The man on the right side claims he had just put on the air when she let go, but as he was not going to make a stop why did he put on the air? Guess he put on the air after the racket began, for report says that when the train stopped he and the fireman were on *back steps of rear coach.*

Indianapolis, Ind. W. DE SANNO.

Location of Gauges for Instruction Plants.

Editors:

The interesting cut that you present in your October issue of the "Ignorance Exterminator" in the D. & H. shops, calls to my mind a suggestion which I should like to make to those contemplating the erection of such an outfit.

It is in reference to the location of the gauges. In my experience as an instructor, I noticed frequently that confusion arose in the minds of the pupils in regard to the explanation on a certain car, because I had a double gauge above it with the red pointer connected to the reservoir and the black one to the cylinder. So many seemed to be bothered trying to remember which was which that I finally adopted the plan of using only single pointer gauges, and in all cases, where possible, screwing them directly into the reservoir or cylinder they were intended to indicate. This proved to be far more satisfactory, as any man seeing a gauge screwed directly into a reservoir knows at once that it is the pressure in that reservoir that it is intended to record. No explanations or labels are necessary. To be sure it does not look as well from an æsthetic standpoint as it would to have them all in a row or artistically arranged in a circle, but one soon learns to regard the greatest use as of the greatest beauty.

I think I hear some one say, "If they are so separated they cannot all be seen from one point," and in reply to that remark I would say that this can easily be arranged by turning all the gauges so that they will face the operator while standing at the engineer's valve, and that if they are of a fair size, with black pointers, no difficulty in that line will be experienced.

Chicago, Ill. PAUL SYNNESTVEDT.

That Lead Question Again.

Editors:

I know the shifting link as usually arranged, with lead increasing as the lever is hooked up, is best for a locomotive, but "Queenslander" wanted to know the capabilities of this most wonderful piece of mechanism, and as you are never intentionally unfair I wish to say that there is no "distortion" in either the arrangement which gives decreasing lead as the lever is hooked up, or in that which gives constant lead for the forward motion, and a lead which decreases from center to corner for back motion. The company for which I work, like many others in the coal regions, has a great number of large reversible hoisting engines, with balanced slide valves and shifting links, the links so arranged that the lead decreases as the lever approaches the center. This arrangement gives security against any failure of the throttle, for the engines can be handled perfectly by the reverse lever alone. One engineer running a pair of engines with cylinders 30 x 60 inches, having slide valves 32 inches wide, can open the throttle in the morning and run all day without closing it, controlling the engines by the reverse alone, and the hoisting is very rapid, and the stops must be made at exactly the same point.

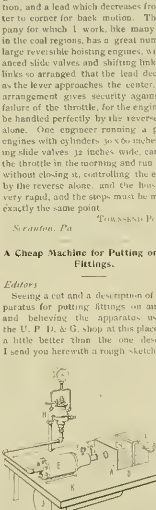
TOWNSEND POORE.

Scranton, Pa.

A Cheap Machine for Putting on Hose Fittings.

Editors:

Seeing a cut and a description of an apparatus for putting fittings on air hose, and believing the apparatus used in the U. P. D. & G. shop at this place to be a little better than the one described, I send you herewith a rough sketch and a



description of our machine. It is the invention of and built by Mr. Ben De Remer, the machinist in charge of air-brake work at this point.

K is a bench built along the shop wall near the rack for testing air pumps. *A* is an oak block fastened securely to bench, the upper portion hinged to the lower one, and a hole through them large enough to take in air hose. *B* is a lever fastened to upper block at one end, *D* is an iron catch fastened to lower block to hold lever of upper one. *CC* is two pins which go through upper block and into lower one to take strain off of hinges and fit loosely so they will raise out with upper block. *E* is a tender brake cylinder bolted to bench, so that piston comes opposite hole in block and about ten inches from it. *F* is a clamp fixed to upper side of cylinder directly over piston, *G* is a hook fixed on upper side of piston in line with clamp above, *H* is a brake valve placed up over cylinder, with gauge *I* on wall back of it, *J* is air pump or reservoir placed under bench.

The operator opens block, places hose in position, clamps it with lever, while leads the fitting and places it in position between hose and piston, applies air lightly, and the fitting is pressed into hose solidly.

One man has, with new hose, put fittings on both ends, together with clamps, ready for bolts, and filled up fifty hose in one hour, and with old fittings has fitted up six hose in one-half hour, complete, putting in both fittings, clamping and bolting both ends of hose and taking out old and putting in new gaskets in all of them.

The clamp and hook on top of cylinder and piston is used to pull out old fittings from worn out or bursted hose.

Just catch fitting on hook on piston, cramp hose through clamp on cylinder and apply air and the fitting is out.

This machine is, I think, about the best for this work that I have seen and is a credit to the builder, Mr. Ben De Remer.

Trinidad, Col. FRANK BRODBECK.

Bunching Trains Where Only Partly Equipped with Air—Bad Inspection the Cause of Much Road Troubles.

Editors:

The argument in favor of engine brakes that may be operated independent of the train brakes, printed in the October number, was evidently written by a man who uses air brakes on the road. Mr. Shaffner tells why he wants an independent engine brake, and his reasons are good, but it is not likely that he will get what he wants, because the manufacturers and purchasers of air brakes know of no practical reason for using independent brakes, and do know of some practical and many theoretical reasons against their use.

I think that whenever the train brakes are applied, every brake shoe on the train and engine should do its wheel squeezing, but I do think, and know, that there should be some means of "bunching" the train—closing the cars tightly together—before the train brakes are applied, and if the heads of the railway transportation departments had ever been train employes in the freight service since freight trains began to be controlled by the air brakes of twenty or thirty per cent. of the cars in the train, freight engines would be equipped with some sort of a brake to close the slack of the train when necessary, regardless of the ideas of the motive power departments and the air brake companies on the subject.

Mr. Shaffner had forgotten his best argument, and but few trains are, as yet, equipped with air brakes "from pilot to caboose." When a freight train has only a number of cars at the head end working air, and this is usual on non-mountainous roads now, it is very hard and almost impossible for the engineer to apply his brakes without causing severe and damaging shocks to the cars and their contents in the rear of the air cars. Theory says to make the service application of from five to seven pounds and the brakes will set lightly and cannot cause the train to jam together. Practice says that when the brakes of the engine and tender and first ten cars of a thirty-car train are applied simultaneously, be it never so lightly, shocks are unpreventable, and I have seen brakemen and conductors wearing court plaster on their foreheads and with stitches in their skin, and even with arms in slings as testimony to that effect; and what is the effect on the goods that are fragile and to be "handled with care"? At first, trainmen were inclined to blame the engineers, and call them "Jonahs" with the air, but soon found that the best air-brake runners on the road gave the caboose as severe punishment as the other engineers did, and the trainmen interested themselves in learning *why*, and most of them have learned a great deal more about the air than the question would seem to suggest.

If the engine and train brakes are in perfect condition, shocks must occur at the lightest application of the brakes, because the train is always stretched when they are to be applied. If using steam, the engine draws out the slack from the head end; when the engineer shuts off, the rear brakeman sets his hand brake and keeps the train stretched to prevent its breaking apart. If it were possible to operate the driving or tender wheel brakes without affecting the train brakes, the slack of the train could be taken gently, after which the train brakes could be applied with any degree of force and no shock would be felt.

On nearly every trip a freight engineer has occasion to shut off and feel for danger; it may be the train he is following, or the siding may not hold the opposing train at the meeting point, or he guesses that there will be orders for him at the station around the curve—if not, there is no time to lose, and if there is he must stop quickly, and he would find a train-bunching brake invaluable. If an engineer scents danger and applies his train brakes easy to take up the slack and slightly check the train, each service application goes toward rendering the quick-action mechanism of the triple valve inoperative; he knows that, and if he could close the slack with an independent driver brake, he would not hesitate to take the advantage offered by the emergency feature of the brakes if a quick stop was necessary, and he could do it without damage to the train or its lading.

I have assumed that the train brakes are in good shape, but of freight car [illegible] not more than a third are in condition to give tolerable service. I refer to [illegible] in the interstate traffic. The trouble [illegible] principally in foundation brakes, but the [illegible] are often defective; one or more [illegible] apply at emergency and thus start the others all the same way. When [illegible] cars in a train but partly equipped with air have triple valve defective in this [illegible] a brake on the engine that would close the slack of the train might pay for itself [illegible] single trip.

The statement as to the condition of freight car brakes may be disputed, but I [illegible] whereof I speak before committing [illegible]. It is the result of imperfect air-brake inspection, or, as is the case in some [illegible] yards, no air inspection whatever. It is a piece of very false economy, but is not peculiar to any certain roads. Of cars that I have seen with defective air brakes, an unproportionately large per cent. of them bore the initials of one of the largest and most prosperous roads in the country, and one of the roads owning the greatest number of air-braked cars.

The railroads have been enlarging their air brake equipment, until now nearly every freight train that goes out on the road has some air-braked cars next the engine, but enginemen and trainmen know that their roads are not getting full benefit of the brakes, because they can see that the brakes are not kept up in shape. It is known that when one-third of the cars in a train have perfect working air brakes it is an easy matter for the engineer to control the speed of his train, and if a train gets into trouble because the engineer couldn't stop it with air brakes on a third of the cars, he is censured or punished according to the extent of damage done, and for an accident for which his employers are directly to blame. He knows when the brakes are not holding his train as they ought, but it is not his duty, nor has he the time to go back and inspect them. The trainmen, too, know when there are defective brakes in their train, but it is hard for them to locate the trouble, and harder still to get them to assume the responsibility of keeping the air brake system in order.

A freight train came in on the east division the other day with bad brakes, and usual, and the next day the same engine and train crew were sent west. The engineer invited me to ride out to the yard with him and look at the brakes on the train which he was to take out. After we coupled on to the train the conductor came up and said it was the same train they had brought in the day before, and he hoped something had been done to the brakes. The engineer made a test application and both brakemen walked back along the train, examining the brakes, and appearing satisfied if the shoes were so tight against the wheels that they could not be moved with the foot. I looked at the piston travel and condition of rods and levers, and they were in bad shape. Some of the pistons were surely seated against the back head, their rods were pushed out so far. Both brakemen disappeared under a car, and I found them trying to take up the slack of the brake rigging with the dead truck levers while the brake was set. They nearly did it, too. The piston was at full stroke, and the shoes were so loose that the boys had the dead levers near to the last holes in the brackets. The engineer released the brake, the levers were drawn to the last hole, air was again applied and the brake of this car set, but the piston still made nearly its full stroke. This was the worst brake in the train, but many other brakes were bad; the train had been in the yards twenty-four hours and the brakes were not looked after, but they were on cars owned by other roads, and that may account for it. There lies the trouble. Cars stay away from home a long time and each and every road should feel duty bound to inspect and keep in good order the air brakes they use, no matter by whom owned.

WILL W. WOOD.

Terre Haute, Ind.

Locating Brake Defects.

Editors:

Some time ago a complaint was made by the engineer running a branch train that something was wrong with a coach brake. It would not release promptly, and sometimes leaked very bad at exhaust port; at other times brake worked first class. The train was engine, tender, combination baggage and smoker, and one passenger coach. Going one way the tender was coupled to the train; on the return trip, front end of engine was coupled to train, there being a pilot on back end of tender. The triple valve was taken down, rubber seat on emergency valve found out of order; no other work done to triple except giving it a good seat; engine was coupled to train at tender, the brake worked very nice, set as it should, and released sure every time; engineer and trainmen pronounced it good. The next trip it was just as bad. Another expert happened around that way, took the offending triple apart, said it was O. K., but that did not make it O. K., for it kept on sticking, not every time it was set, but often enough to be troublesome. By this time the engineer had noticed it only stuck on them when front end of engine was coupled to train. He uncoupled the hose, opened angle-cock, a very small amount of air came out, showing a stoppage somewhere.

On taking off the angle-cock the whole trouble was found. At some time the angle cock had been broken or taken off and a wooden plug driven in the end of pipe. When the machinist came to put another angle cock on it was easier to drive the plug into the pipe than to get it out, so he drove it inside and left it there. This plug was just loose enough to slide along in the pipe and let some air get past it, so a service application could be made, but when air was turned back into train-pipe to release brake, plug slid up against angle-cock and air went past it, so slow coach brake failed to let off as promptly as it should. Now, if it had been stated in the first place that brake worked first-rate when coupled to tender and poorly when coupled to front end of engine, the trouble could have been located at once as a stoppage in train line at front end of engine. If it had been stated that coach brake had to be bled each time it stuck, that pumping up a high train line only made it stick tighter, it would have indicated a leaky piston-packing ring in triple, two faults which did exist; when these two faults were cured, brake worked as it should. When coupled to a clear train-pipe, the excess pressure took care of the leak past triple piston, but when it had to get by the wooden plug slow, train-line pressure in coach increased so slow the leaky ring got its work in most every time. Excess pressure takes care of lots of leaky piston-packing rings.

Here is another one:

A driver brakes triple was reported out of order; another one was put on which would not work at all. An expert was called on for an opinion. He said, "Try the brake." It did not set, no air came into brake cylinders from the triple; it looked like a case of blind joint in one of the unions; the auxiliary had a good stiff pressure in it before setting the brake and none at all after an emergency application, and train line was emptied. When brake was tried first time with service application the air-brake man noticed there was air enough came out of train line exhaust for at least six cars, and it was a four-car train, so he made a mental note that D 8 valve ought to have the equalizing piston fixed, as it stuck open after the pressure was equalized. On a closer examination the triple was found to have been piped wrong when it was put up by the machinist, the train pipe being coupled to top connection of plain triple and driver brake cylinder pipe coupled on where train pipe ought to be. When this job was first done and triple piston was up in full release position, air came out of exhaust a full stream from train pipe by passing under air valve No. 6 through exhaust cavity, so it had to be cut out at four-way cock, but after the piston had worked down so exhaust was covered and air could accumulate in auxiliary reservoir it pressed piston down to the bottom of its stroke, thus holding air port over valve 6 open so there was open communication between train line and auxiliary. When train line reduction was made to set the brake the air pressure in this auxiliary had to be reduced also, thus adding about two and one-half car lengths to capacity of train pipe, which explained the peculiar action of brake valve piston. Also when testing brake valve for sticky piston, after trouble was located, with angle cock on rear of tender closed so as not to set train brake every time, the usual blow-out of train line exhaust after releasing brake with short train line was not heard, another evidence of train line longer than ordinary engine and tender. The triple was cut out for that trip, piping put up properly and brake now works as it should. When you tell about a curious action or brake failure give all of it, then the trouble seems easy to remedy.

CLINTON B. CONGER.

Grand Rapids, Mich.

Overcoming Leaks in Signal Apparatus.

Editors:

Speaking of the improved Westinghouse feed valve for the signal apparatus reminds me of an arrangement which I put on several locomotives in order to circumvent the omnipresent little leak, which, working in conjunction with a slow-feeding reducing valve, committed such depredations upon the engineman's peace of mind.

This device, which was simply a small spiral spring placed over the diaphragm in the signal valve, Fig. 4, Plate 3, was designed to render the valve responsive only to a sudden reduction in the signal pipe pressure, while a small leak equalized without moving the diaphragm.

The spring was, in every case, three turns of the kind used under the overflow valve in the Mack injector No. 7.

One end of the spring was straightened and driven into a small hole drilled in the top of spindle 10, thus pressing against spindle 10 and the top of the hollow which receives nut 8.

This arrangement has always given satisfaction, and needless to say has saved to us much labor in hunting for little leaks under tanks and other "pleasant" places with soap and water and brush.

Boston, Mass. GEO. E. LYNCH.

Proportioning Oil to the Kind of Engine Used.

Editors:

The article in the current number of the LOCOMOTIVE ENGINEERING from the pen of Mr. C. B. Conger, in regards to the economical use of oil supplies, broaches a very important subject for railway people to consider, owing to the different sort of engines in service on trunk lines and short roads.

Some companies use a high wheel and a small cylinder, which renders efficient service on level roads, but roads that have steep grades require large cylinders and low wheels, that they may compete with the road having no grade in the way of hauling an equal number of cars with any additional expense.

An engine with a high wheel and small cylinder may run a division comfortably well with a small amount of cylinder oil, while an engine with a low wheel and large cylinder capacity could not begin to run the division with such small quantity of cylinder oil without doing damage both to the valves and cylinders.

Mention will be made of a few engines of ordinary dimensions running on roads with heavy gradients, excluding Baldwin compound decapods with its multiplicity of cylinders and numerous bearings to be oiled.

A mogul engine with a wheel 56 inches in diameter and cylinder 18 x 24 inches will cover a space of 14.66 feet (3.1416 times 56 inches) in making one revolution, and in running a division of 100 miles (5,280 feet by 100) it will make as many revolutions as 14.66 is contained times in 5,280,000 feet, or 360144.

Since for each revolution the piston travels two times through the cylinder, or 4 feet in making 360144 revolutions it will travel equivalent to 1440576 feet.

A mogul with the same size cylinders and a 68-inch wheel will pass over a space 17.8 feet for each revolution, and in running the above division will make 296589 revolutions and the piston will travel equal to 1186357.3 feet. This makes a difference of 254218.9 feet in piston travel in favor of the latter engine, an important item to be considered in apportioning oil supplies.

To illustrate more fully and show these facts more minutely, a 10-wheel passenger engine and consolidation engine will be considered, both having cylinders 20 x 24 inches, with a 68 inch wheel and a 50-inch wheel, respectively.

The consolidation engine will cover 13.09 feet in making a revolution and will revolve 403361.3 times in running the division, and since this one's piston also travels 4 feet for every turn of the wheel, its piston's travel amounts to 1613445.4 feet.

The diameter of this cylinder is 20 inches, its circumference is 5.231 feet and its internal area is 10.472 square feet, but as the piston travels 4 feet for each revolution its actual area is equivalent to 20.944 square feet and for 403361 and .3445 revolutions it will be 8447990.9 square feet. This result may also be obtained by multiplying the distance travel of the piston in going over the division by the circumference of the cylinder.

The 10-wheeler with its 68-inch wheel will make 296589 revolutions in going over the same division, and since its cylinders are of the same dimension as the consolidation engine, its interior area for each revolution will be 20 944 square feet, and its internal surface for the division will be 6211764 5 square feet, hence the difference in the surface to be lubricated in these engines is 8447999 9 square feet minus 6211764 5 square feet or 2236235 5 square feet in favor of the ten wheeler.

As this shows the result obtained for one side, for both sides it will be 4472-471 square feet.

A vast surface less to be oiled in this style of an engine, yet they are allowed as much cylinder oil as the consolidation engine.

This is the cause of engineers on the ten wheel engines borrowing oil from their neighbor's engine during his absence, with a view of not returning it. Engineers never steal.

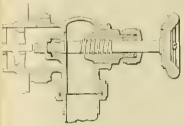
In my opinion, there should be some discrimination made in the distribution of supplies among these engines with regards to the service they are required to perform, and not be as arbitrary as the sagacious yardmaster with his irrevocable commands and absolute authority in assigning a certain complement of cars for engines to haul without regards to the capacity of the cars or the capability of the engines. J. F. Barrett

Carbondale, Pa.

Safety Steam Valve.

Ed.:

I send you herewith a print of a safety steam valve. It is, I think, an improvement on the ordinary style, and as far as it goes will do the work that it is designed for, namely, prevent the steam from escaping in case the body is broken off, but



anybody can see that it is of no particular value should the check pipe break or become detached, but still I think it is an improvement on the regular style used.

It is easy to get at in case of a leak; it can be reground without much trouble, can be placed in any convenient place in the boiler. H. A. Frackelton

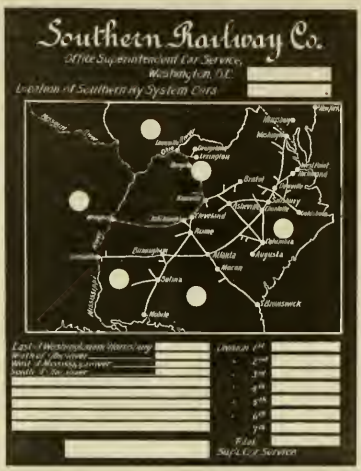
Allegheny, Pa.

We had in this office a stenographer and typewriter who was celebrated for the severely practical way she would interpret the matter given to her by those who did the dictation. Shandy Maguire, the railroad poet, had signified his willingness to write a poem about Locomotive Engineering, if some points were furnished him about what should be said. Accordingly, the J. P. called the stenographer to his assistance and dictated a long letter of pointers. He concluded: "If you let your muse loose upon that you are sure to make something worth reading." His emotions were beyond words when he found that the typewriter had written, "If you let your mules loose upon that," etc.

It is only a few years since the preserving and drying of fruit was begun in California, yet the industry has now reached astounding proportions. The business has been rather depressed this year, like that of most other lines, but up to September 20th the following shipments of California fruits to Eastern points were made: Raisins, 280 carloads; other dried fruits, including prunes, 1,100 carloads; green fruits, 5,500 carloads; canned fruits and vegetables, 1,900 carloads.

A Graphic Car Report.

We show herewith a blue print of car report used by the Southern Railway Co. It shows at a glance just what part of the



A Graphic Car Report.

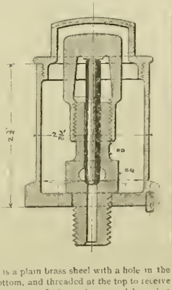
system its cars are located on and in what part of the country, outside of the lines, that the tramps are located. We think it a great improvement over the ordinary blank car report.

A Sensible Oil Cup.

The cuts shown herewith will make plain the details of a new oil cup recently put on the market by F. J. Cole, of No. 1605 John street, Baltimore, Md.

It has distinct advantages over the ordinary cup that are plain at a glance.

In the first place, the cup itself has no stem, to be twisted off by a fifteen-inch monkey wrench with no sense behind it.



It is a plain brass sheel with a hole in the bottom, and threaded at the top to receive the cover. It has a hexagonal base, but this is not at all necessary.

The central plug is steel and screws (through the bottom of the cup) into the rod, its upper end is threaded to receive the split yoke that serves as a stop to regulate the throw of the plunger. The plunger is heavy enough to always seat itself and in the thickest oil, and thus prevent waste while engine is standing still.

The yoke can be adjusted with the fingers. The plug is screwed through the cup by a special socket wrench furnished with each set of cups—one end serving as a wrench to remove the cover.

This cup can't be stolen by turning it out with a common wrench. It cannot be broken off with a blow. It cannot be broken by ignorance in putting on, and it cannot be jarred loose.

This cup is a plain, neat, sensible affair, and will doubtless meet with a good demand when its merits become known beyond the confines of the B. & O. road, where it originated, and where it is extensively used.

Locomotive Engineering has declined to be the official organ of several railroad associations. There is nothing like being free to publish only that part of everything that is thought to be interesting.

A Safety Turret Device.

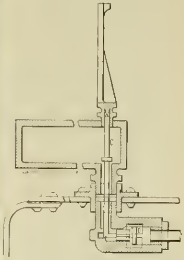
Mr. E. L. Penruddocke, of Scranton, Pa., sends us prints of a device he has recently gotten up to prevent scalding accidents.

He describes the device as follows:

The turret is screwed into a flanged joint which is riveted to boiler, and into same flange is screwed an angle valve or check, to which is connected the steam pipe from dome.

The valve *D* in the check is held open by the spindle *C*, which extends into steam gauge stand.

The turret has a weak neck at its con-



nection with flange, so that it would in all likelihood be broken there. This would allow the spindle *C* to be lifted by the valve *D*, and, coming just above the opening of turret, the steam would help to lift it, and so allow the valve *D* to close. Should only the steam gauge stand be broken, as it is made weak at its connection with turret, this would also allow the spindle to lift, and so close the valve.

The valve being inside of the boiler and lying horizontally, it would be protected from any débris that might fall and so displace it.

During our fiscal year (ending September 30) Locomotive Engineering received $10,235.35 *more* for subscriptions than were received in the same time for advertising. We doubt if there is another trade paper in the business that can show so healthy a subscription department. We are willing to prove this to advertisers by the books.

The Baldwin Locomotive Works are putting into their erecting shop weighing scales which have a capacity of 300,000 pounds. They think that when locomotives become too heavy for the capacity of these scales that it will be time to remove the works to some place where there is a good rock foundation.

Second Annual Convention of Traveling Engineers.

We have received from Secretary Thompson proofs of the proceedings of the Second Annual Convention of the Traveling Engineers' Association held at Denver, Col., in September last. There were thirty-five members present, viz.: S. J. Kidder, C. E. Slayton, M. M. Meehan, P. J. Carney, R. D. Davis, F. P. Wilson, G. Lamplugh, H. C. Fraser, T. A. Hedendahl, D. R. McBain, N. S. Moore, W. J. Anthony, Meritt Turner, George Royal, M. Mast, A. J. Schevers, C. Davis, P. H. Stack, George Royal, Jr., Wm. Conger, J. H. Little, M. E. Rapp, C. McCollum, C. B. Conger, J. W. Hall, W. O. Thompson, Martin Monroe, F. Selgrath, C. A. Dixon, J. H. Kirchgraber, W. R. Scott, J. Conroy, R. McVicar, P. P. Egan, W. C. Chapman.

President Conger in his opening address dwelt first on the necessity and importance of members interesting themselves actively in the work of committee. They were urged to furnish all the information in their possession to committees, and assured that they themselves would learn more by reporting on what they know. They were particularly warned against the danger of getting into ruts that fenced out improvements or the desire to make a better record. "Well enough" is a dead man's doctrine. The belief was expressed that the master mechanics are improving the locomotive every year, and it behooves the traveling engineers to see that the methods of handling be improved also. The indications are that the members are doing their duty in this, for with the higher speed and heavier trains the economical performance is steadily improving.

Learning the business of running a locomotive is now much more difficult than it was a few years ago. The need of education is much more decided than in the past, and members were urged to encourage their men to habits of study.

The reports of secretary and treasurer showed the association to be in a flourishing condition.

Several new regular and associate members were admitted.

The first report read was on "The true and false economy of caring for and the safe handling of the air brake under all conditions; and when examining a fireman for promotion, how much knowledge of the air brake is it necessary for him to have to be considered fully competent to take a train on the road." This is an excellent report, and is highly creditable to the committee, Messrs. R. D. Davis, T. A. Hedendahl, C. E. Weaver, F. C. Schraag and L. S. Putnam. The class of men who supply facts for these reports know as much about the prevailing condition of air brakes as any men alive. Part of this report says:

CONDITION OF AIR BRAKE.

"We find cars with the braking power reduced far below the best recognized practice, for the purpose of economizing in the cost of renewing flat wheels, and at the same time this false economy is but an invitation for a wreck sooner or later.

"We see engines running without a governor to control the train line pressure, the fact being entirely overlooked that the apparent economy in saving the cost of a governor is many times lost by resulting damages to rolling stock, in one form or another. We see pumps kept in service which have become greatly impaired by long use or lack of care, the fact being entirely overlooked that the continued use of such defective machinery lacks the essential features of economy.

"We see engineers who, in handling their engines, realize the importance of carefully taking the slack of the train, but in the manipulation of the brakes look for their proper performance regardless of the manner with which they operate the brake valve handle. It is a recognized fact that the different appliances pertaining to an engine or train require occasional care and attention, while the air brakes when once attached to a car or engine are expected to perform their proper functions with no care so long as they will do their work, and the only time they require repairs is when they fail completely to perform their mission. Even then, in many instances, the work of repair is put in the hands of men who little understand mechanism of the kind, and needless time and money are expended in doing what in the end proves to be an imperfect job."

This is certainly false economy.

A strong plea is made for first-class material in brakes to start with, the strict maintenance of standard parts and the avoidance of make-shifts. Cheap, inferior help for doing air brake work was condemned as false economy.

In passing a fireman for promotion it was recommended that he should be very familiar with the working of the air brake from beginning to end. He should be able to report intelligently on defects of the brake and competent to handle it with skill and knowledge of the principal details.

EDUCATION OF FIREMEN.

Mr. Turner thought it would be impracticable to educate the firemen to the extent suggested by the committee.

Mr. Davis thought differently. There was no difficulty in getting an intelligent fireman to learn all about the air brake.

Mr. Clayton said their practice was to keep a fireman back from promotion if he did not post himself sufficiently about the air brakes. This has a very salutary effect on the young men.

A discussion arose about the necessity for new engineers knowing the road before they went out with a train handled by air brakes, and the general opinion was that knowing the road was of the first importance.

Mr. Hedendahl dwelt upon the importance of discussing air brake matters thoroughly. The subject occupies the attention of locomotive engineers more than any other, and it ought to have proper attention in these meetings.

Mr. Turner said that they did not have one engineer running who was not capable of starting out with an air-braked train and placing everything in shape so that the air would not fail.

A discussion arose about the advantage of applying the brake of the caboose when a train composed partly of air brake cars was approaching a water station. Some opposition was expressed to the practice, but the general opinion was that it prevented shocks and saved couplings.

Next report was on—

"What is the best means of saving coal and increasing or holding the mileage per ton at a desirable figure?"

ECONOMY OF FUEL.

This report, prepared by M. Mast, W. E. Chapman, J. W. Sheldon, G. H. Brown and P. A. Rossiter, consisted of forty questions, with the answers given in condensed form. It covers the subject fairly well. The principal means recommended for economical use of fuel is careful firing and skillful handling of the engine in regard to feeding and using the steam expansively. The brick arch is also commended as a good auxiliary. A curious statement is made to the effect that five roads report that their firemen disobey instructions about careful firing, expecting that seniority will save them their jobs. The premium system as an encouragement for saving fuel is commended by most of the roads that answered the circular, but some of them believed that it tends to make firemen dishonest.

Next report was on "What relation does a clean engine bear to the economical use of oil and supplies?"

CLEAN V. DIRTY ENGINES.

The committee was J. W. Hall, J. B. Johnson, Chas. B. Hogan, C. W. Poole, P. E. Riley.

This consisted of twenty questions with condensed answers. The answers show that most railroad men are in favor of clean engines, although unwiped engines is the rule rather than the exception.

The Committee say that clean engines cut quite an important figure in the economical use of supplies. A few of the benefits derived from well-cleaned engines are: Men are more careful, take better interest in their engines, and take pride in making good showings on the monthly performance sheet; it aids inspection, thereby reducing failures; discipline is better maintained, holding extravagant men in check by comparison; it prolongs wearing parts, it reduces cost of repairs. Clean flues and grates give greater heat, and effect a saving of coal. Clean boilers are kept well washed, so they will not prime (which is often lost sight of in rush of business), effect a saving of valve oil, also less valve rod and piston packing is required. Close attention to smoke arch, nozzles and other front end work, more especially keeping nozzles well cleaned out, makes a very perceptible showing on the coal pile. We could follow to any length, and from every point of view the conclusion must and would be the same.

That covers the whole subject.

EXAMINATION OF FIREMEN.

The next report is on "A uniform form of examination of firemen for promotion and new men for employment," and is probably the most valuable in the report. The committee was M. M. Meehan, J. G. Goodman, J. A. Hill, J. W. Sheldon, H. T. Hamar. It consists of 91 questions, covering the whole field of knowledge respecting the locomotive and its appurtenances and the best methods of operating the same. The report cannot be condensed, but all of our readers will receive it with our January issue.

POOLING ENGINES.

The last report is entitled, "How can traveling engineers improve the service when engines are double-crewed or pooled?" The committee consists of W. T. Simpson, P. Fraser, W. Conger, J. O. Bradley, C. M. Brinsley. The tone of the report is to the effect that the practice of extra crewing and pooling of locomotives has come to stay, and it is the duty of all concerned to work it to the best advantage. An extract from an opinion given by one of the members appears to cover the case. He says:

"If all take the interest in pooled engines we did under the old methods, one-half the time formerly given by the engineers and firemen put on pooled engines will keep them in good shape, and idleness of engines will be reduced to a minimum. There is no doubt that a system is needed. The best that can be done to form a system is to anticipate the demands on your particular line and provide for these demands, making such changes as experience calls for. Roads that the pooling system has been in use on present our best field for information. The first and most important requisite is to obtain the co-operation of all concerned. If personal comfort is checked by the change, check it as little as possible. If waste occurs, reduce that as quickly as possible. Anything that can be done by roundhouse men should be done well and done under the personal supervision of a competent man. Have as little work done by the engineer and fireman as possible. Have the engineman simply operate the engine on the road and report what work is needed. Have competent inspectors and shop men to do the rest. The requirements of trunk lines are so exacting, and so much is expected of enginemen, that they cannot work on their engines on the road or be harassed with inferior facilities."

Block Signaling.

Mr. W. G. Wattson, chairman of the American Railway Association's Committee on Signaling, presented an interesting report on Railway Signaling at the meeting of the Association held in New York last month. He said there are three distinct systems of block signaling worked to a considerable extent on American railways, all of which have been sufficiently developed under conditions that admit of their capacity being reckoned with accuracy, viz. The telegraph block signal system, which is operated manually as directed by telegraph; the controlled manual block signal system, which is operated manually but prevents by mechanical device or otherwise the display of a clear signal while the block is occupied by a train; the automatic block signal system, which is self-operative, whether by mechanical, electric, pneumatic or other device.

There is a marked difference in the capacity of these three systems—that is, in the number of trains that can be moved over a road under the protection of block signals in a given time. With the telegraph system, the signalmen are required to record the time of all passing trains, to report to the signalman in the rear and in advance, and to manipulate a number of signal levers, all of which requires more or less time. In the operation of the controlled manual system practically the same procedure is required, but owing to the use of distinct and advance signals which are worked quickly by mechanical devices and which are not used to advantage in the telegraph system, more trains can be moved in a given time, especially during fog and storm, than under the telegraph system. With the automatic system, everything being self-operative, the factor of time required in the operation is reduced to the minimum, and the capacity of track is limited only by the maximum length of the trains, their speed and the efficiency of the train brakes. Therefore, so far as capacity is concerned, the telegraph system represents the first stage of block signaling, the controlled manual an improvement over the telegraph system, and the automatic the system of greatest possible capacity.

He then argued that railroads handling considerable traffic could no longer afford to do without block signaling. It is the best kind of insurance and the introduction of this means of safety is a duty that cannot longer be neglected. Those interested in each system claim that it is superior to all others, but each road should consider which system is adapted to meet the requirements of their own particular service.

The cost of installation of plant and expense of operating varies greatly between the three systems. The cost of installing the controlled manual plant and the permanent monthly expense for a signalman and repairman is very great. The cost of installing the pneumatic automatic plant and also the cost of maintenance is greater than the controlled manual, but the cost of operation is somewhat less, no signalmen being required. The cost of either of these systems prohibits their introduction on any lines except those enjoying so large a volume of traffic as to overtax the capacity of the telegraph system. The electric automatic system costs less for operation than the controlled manual and less for installation and maintenance of plant than either the pneumatic automatic or the controlled manual. However, with the installation of the electric track circuit system, which is the only reliable electric system yet developed, there will sometimes be involved a large expenditure in the preparation of track for its introduction, a thoroughly drained roadbed and an entire absence of cinder ballast being essential to the maintenance of a reliable circuit. Therefore, under certain conditions, the electric automatic system may be as costly to install, maintain and operate as the pneumatic automatic system.

For crowded lines, with fast and slow passenger trains and freight trains moving on the same track, he advocated the use of the automatic manual system. For moderate traffic the telegraph system will afford protection without hampering the movement of traffic. On roads running through sparsely settled districts the electric automatic system was recommended

Prevailing Defects of Car Brakes.

One of the reports presented at the Traveling Engineers' Convention, said

"As a rule passenger car brakes are found to work fairly well on most well regulated railways, but in a great many instances brakes are found with altogether too great variations in the range of piston travel, viz from 4 inches to 12 inches in one and the same train, which cannot be construed as 'true economy' in the air brake field. As a mechanic cannot execute first-class work with inferior tools, neither can a locomotive engineer do first-class braking with poor brakes.

"But let us go back and investigate as to the primary cause for such great variation in piston travel. In most instances the brake shoes are found to hang a very uniform distance from wheels on all cars, suggesting that car men in charge give to this point alone their exclusive attention, and supposing that the distance which brake shoes hang from the wheels (when brakes are off)strictly governs piston travel, which in itself is most absurd, inasmuch as the rigidity or flexibility of brake beams and levers regulates to a great extent the above as well as the brake leverage. The number of times the piston power is multiplied on the brake beams, is also a very important factor in this respect; hence it is absolutely necessary that car men, in order to produce proper results, strictly govern themselves by the distance that pistons travel under a full force application of brake, irrespective of the position of brake shoes, except that shoes must hang clear of and parallel to wheels when brakes are off

"While discussing the piston travel on cars and tenders it may be well to analyze its effects under various conditions All who have given the subject attention, either practically or theoretically, fully understand the evil results of greatly differential piston travel viz with the automatic brake, each brake cylinder obtaining its supply of air pressure from its own auxiliary reservoir, which, when brakes are applied, is entirely separate and distinct from all others in the same train, while prior to an application all reservoirs are united through train pipe, and have nominally a uniform pressure. Now, if one piston has 4 inches of travel, the small quantity or volume of air drawn from the auxiliary reservoir necessary to fill this 4 inch space in cylinder would reduce reservoir pressure but 8 or 9 pounds when pressure in the two chambers is equalized, and brake fully on Thus it auxiliary pressure be 70 pounds before application is made, this cylinder would have 61 or 62 pounds (with service application), or from 11 to 12 pounds in excess of calculated pressure, viz., 50 pounds, and this full force application would be also produced by a train pipe reduction of only 8 or 9 pounds. Then, assuming another piston to travel 8 inches, and requiring consequently a double quantity of air as compared with the former, and also reducing the auxiliary reservoir pressure about double, or from 16 to 18 pounds, thereby leaving but 52 to 54 pounds of cylinder pressure, and if another piston travel 12 inches, it would take about three times the volume of air as compared with the one of 4 inches of travel, and also reduce the auxiliary pressure from 24 to 27 pounds, and leave but 43 to 46 pounds of effective cylinder pressure. It also remains a fact that with 12 inches of piston travel, if the piston does not quite come against cylinder head (thereby destroying all brake power on this car) it requires but a very few applications of brake and the slightest wear of brake shoes to bring this about.

"Now, assuming the three cars referred to above are of a uniform light weight, and are carrying an indicated leverage of 10, the one having a piston travel of 4 inches would be exerting a power of 48,000 pounds, with a service application of over 100 per cent. of power to the weight of car, hence slid flat wheels would certainly follow.

"The car having a piston travel of 8 inches would be producing a total power of about 42,000, which would be very close to the limit for which brake was calculated, viz., 90 per cent. of power to light weight of car.

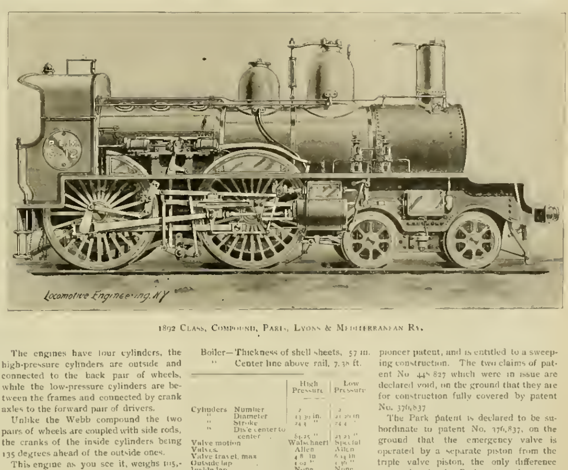
"The car with a piston travel of 12 inches would carry from 34,000 to none.

"Another serious feature arises from this great difference in piston travel, viz., brakes 'sticking.' For example, the brake having the shortest piston travel would reduce by expansion the auxiliary reservoir pressure but slightly, thus leaving a higher pressure to be overcome by train-pipe pressure—hence the more apt cause 'sticking'—than those of longer travel.

"Abnormal variation in piston travel resolves itself in the following, viz. Flat slid wheels, 'sticking' brakes, irregular and poor-holding brakes as a whole, train jerking when making application of brakes, and hence I believe that uniformity in piston travel comes within the limit of 'true economy.'"

A French Compound.

The handsome engraving on this page will make plain the details of a large compound locomotive that has been doing work for the past two years.



1892 CLASS, COMPOUND, PARIS, LYONS & MEDITERRANEAN RY.

The engines have four cylinders, the high-pressure cylinders are outside and connected to the back pair of wheels, while the low-pressure cylinders are between the frames and connected by crank axles to the forward pair of drivers.

Unlike the Webb compound the two pairs of wheels are coupled with side rods, the cranks of the inside cylinders being 135 degrees ahead of the outside ones.

This engine as you see it, weighs 105,600 pounds.

These engines are among the first in that country to have steel fireboxes, this was done to reduce the weight; the thickness is 39 inch.

The tubes are the Serves ribbed kind, and are only 9 feet 10½ inches long and of 2 inches diameter.

The barrel of the boiler is 51.97 inches, and there are 133 tubes used.

The Walschaert valve motion is used for the high-pressure cylinders and an independent valve motion of special design, without eccentrics, for the low-pressure cylinders Both motions are controlled by a single steam reversing gear so arranged that for each point of cut-off there is a definite ratio between the expansion in the high and low pressure cylinders.

The starting valve is provided, admitting live steam into the receiver between high and low pressure cylinders through a small pipe designed to be used only in starting. Excess of pressure in the receiver is avoided by a relief valve of ample size. The receiver is unusually large for a four-cylinder compound, being over four and one-half times the volume of the high-pressure cylinder. The truck center bearing is arranged so that the front of the engine is slightly raised in curving or by lateral displacement, the truck tending to return to a position parallel with the longitudinal axis of the engine when free to do so. Lateral motion is limited to .59 inch.

The following are the principal dimensions of the engine with four-wheel truck

Grate surface, 24 97 sq. ft.
Firebox—Length inside at grates, 87 8 in.
" Width inside at grates, 40 95 in.
Tubes—Serves, ribbed.
" Material, steel.
" Number, 133.
" Outside diameter, 2 56 in
" Thickness of, .098 in.
" Length between sheets, 9.84 ft
" Number of ribs in each, 8.
" Height of ribs, .47 in.
" Thickness of ribs, .098 in.
Heating Surface—Firebox, 112 16 sq. ft.
" " Tubes, 1478.79 sq. ft.
" " Total, 1590 95 sq. ft.
Boiler—Diameter of cylindrical part, 51.97 in.
Boiler—Thickness of shell sheets, 57 in.
" Center line above rail, 7.38 ft.

	High Pressure	Low Pressure
Cylinders Number	2	2
" Diameter	13 39 in.	21 26 in
" Stroke	24 4 "	24 4 "
" Dis'e center to center	84.25 "	21 21 "
Valve motion	Walschaert	Special
Valves	Allen	Allen
Valve travel, max	4 8 in	6 14 in
Outside lap	1 02 "	1 16 "
Inside lap	None.	None
Steam Ports Length	9.45 in	13 in
" " Width	1 41 "	1 02 "
Exhaust Ports Length	9 45 "	13 "
" " Width	3 15 "	24 "
Volume of receiver		9.18 cu ft
Driving wheel base	1 6.27 in	
Truck " "	78 71 "	
Total " "	271 06 "	
Driving wheels diameter	78 74 "	
Truck " "	39 37 "	
Weight in working order on truck		33,15 lbs
Weight in working order on forward driving wheels		31,160 "
Weight in working order on rear driving wheels		[illegible] "
Total		105,600 lbs

We are indebted to the *Revue Generale des Chemin de Fer* for our information.

Final Decision of the Air Brake Suits.

The United States Court of Appeals has rendered a decision in the infringement suits of the Westinghouse Air Brake Company against the New York Brake Company, which is final. It will be remembered that about one year ago, Judge Townsend of the United States Circuit Court, handed down a decision enjoining the New York Air Brake Company from furnishing the air brake apparatus they had been manufacturing and selling.

An appeal was taken from the decision of Judge Townsend, and the decision now rendered by the United States Circuit Court of Appeals has reference to the appeal from Judge Townsend's decision.

It was decided by Judge Townsend that both forms of the triple valve which had been furnished by the New York Air Brake Company, infringe two patents issued to George Westinghouse, Jr., which were respectively Nos. 376,837 and 448,827, and they were enjoined under both patents He denied an additional injunction, asked for under the patent of Harvey S Park, No. 393,784, now controlled by the Westinghouse Air Brake Co. He also granted an injunction against the New York Company's engineer's brake valve, under a patent issued to George Westinghouse, Jr.

The decision of Judge Townsend is affirmed by the Court of Appeals in all respects, except as to Westinghouse patent No. 448,827, in reference to which the decision is reversed The Court of Appeals broadly and forcibly holds that patent No. 376,837 (which is the patent for the style of brake apparatus now in general use) is a pioneer patent, and is entitled to a sweeping construction. The two claims of patent No 448 827 which were in issue are declared void, on the ground that they are for construction fully covered by patent No. 376,837

The Park patent is declared to be subordinate to patent No. 376,837, on the ground that the emergency valve is operated by a separate piston from the triple valve piston, the only difference being that in the Park patent the emergency piston is operated by train pipe pressure instead of auxiliary reservoir pressure

All of the brake apparatus of the New York Air Brake company which came under the injunctions of Judge Townsend is still under injunction It also appears from the decision of the Court of Appeals that patent No 376,837 of the Westinghouse Company broadly covers all constructions of triple valves in which the emergency valve is operated by a separate piston from the triple valve piston.

It takes from fifteen to twenty years for a person in the United States to obtain a patent in Mexico. The great delay is not of much consequence, because after a patent is applied for the inventor has protection.

The Tower Coupler.

The cuts shown herewith illustrate the M. C. B. coupler now being put on the market by the National Malleable Castings Company. It is known as the "Tower" coupler, and is of the knuckle opening class, in operating the knuckle from the corner of the car no additional parts are required, either in the unlocking gear or the coupler itself. It has been very carefully designed, and the metal properly distributed to meet the strains encountered through that contact, instead of by contact with the outer face of the opposing knuckle. This is conducive to smooth action in coupling, which is further promoted by the fact that the lock does not have to be raised as the knuckle swings in. This also prevents the binding and failure to couple, to which certain couplers are liable. From Fig. 2 of our illustration it will be seen that the buffing strains received by the knuckle are transmitted to the head by means of a broad flat bearing at the end of the tail of the knuckle. A tendency than one of compression. To uncouple, the lock is raised until it strikes the under side of the top wall of the head, being guided vertically in this movement by the bearing of its stem in the bottom wall of the head. If it is desired simply to unlock the knuckle, the lock is held in this position by the unlocking position in the usual manner. If, however, it is desired to swing the knuckle open, the lever of the unlocking gear is lifted still higher and, the lock, pivoting on a ridge on the top wall of the coupler head, is rotated about lock swings the knuckle open in a way that is perfectly clear from Fig. 1. The lock remains in the position shown in dotted lines after the operator has dropped the unlocking lever, and only falls into its normal position when the knuckle closes.

The lock cannot be interfered with in its operation by ice, dirt or cinders. It is provided with ample bearing surface on the knuckle, the area of contact being 4½ square inches. It cannot be struck by coupler links, as they cannot enter the

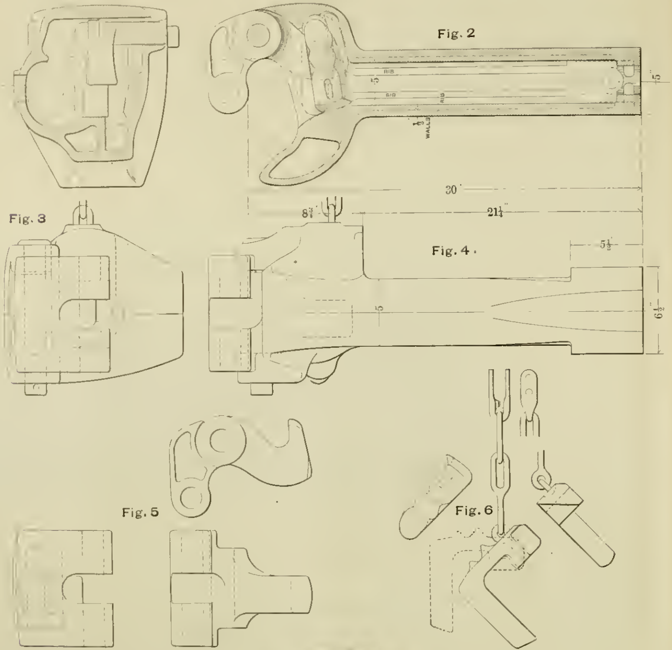


Fig. 1 Fig. 2 Fig. 3 Fig. 4. Fig. 5 Fig. 6

in service. The merits of the coupler may be concisely stated to consist in its simplicity and great strength, combined with a meritorious knuckle-opening device which does not add any parts to the coupler, and which cannot get out of order.

The body of the coupler is made of malleable iron, and the knuckle, lock and pivot pin are of steel. The shank is square for its entire length and the liner blocks are cast on. The walls of the shank are thick and well ribbed, but sufficient room is left for the use of a tail bolt, if desired, and a slot for the American continuous draft rigging can be added. The knuckle is fulcrumed back far enough to give great strength to both it and the head, and yet smooth action is obtained even on the sharpest curves. The face of the tail of the knuckle is so shaped as to come in contact with the outer face of an opposing knuckle when in the act of coupling, so that it is swung into the closed position for the knuckle to rotate inwardly under these blows is also resisted at the same point and by a bearing against the vertical wall of the head at a point considerably nearer the fulcrum pin. By its shape and size the knuckle is amply strong to receive and transmit without damage any strains encountered in service.

The conspicuous part of the coupler is the lock which also serves to throw the knuckle open. Its shape will be readily understood from Figs. 1 and 6 in our illustrations. In Fig. 1 the full lines show the lock in the normal position, and it will be seen then, when receiving the pulling strains, the lock is firmly supported by a vertical wall on the guard-arm side of the head, so that it is subjected to no strain other that point, as shown in Fig. 1, the stem of the lock disengages from the hole in the lower wall of the head, and slides along a groove provided for it. This motion of the head far enough owing to the size of the tail of the knuckle.

All parts of the coupler are carefully inspected and made to conform accurately to standard contour lines. The Tower coupler has been repeatedly tested under the drop and for a considerable period in service, and has fulfilled all requirements. The railway department of this company's business is located in the Old Colony Building, Chicago.

The Hall Signal Co. have received an order to equip the yards at Los Angeles, Cal., for the Los Angeles Terminal Co. This is the first order of modern signals for the Pacific coast.

We have received so many requests to send books to subscribers that we have determined to open a book department. We will supply any engineering book at regular rates.

*Railroad Coppersmithing—XII.

By John Fuller, Sr.

SHIP VENTILATORS.

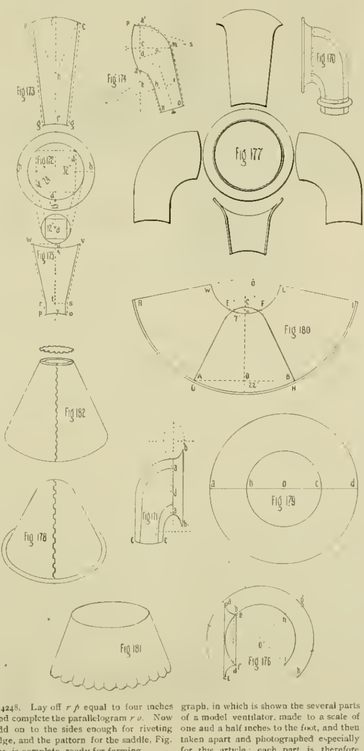
In many railway shops, as also in private engineering shops, ship ventilators made of sheet iron are sometimes in great demand, and I have seen some unpleasant disappointments, together with wasted material, seemingly from the want of a geometrical perception or training, and as a result very many unsightly jobs are sent out which could have been avoided. Before proceeding to give the instruction how to produce a pretty, symmetrical ventilator, let me say, this piece of work, if made by hand, requires more than ordinary mechanical skill, and should command and receive proper recognition in wages. I have made many dozens of ventilators, and in several different ways, and have spent much time and study on them, and after repeated failures have succeeded in devising a method to excel not alone in symmetry of form, but to reduce the time and trouble usually expended in making to a minimum.

In Fig. 170 are shown the outlines complete of one of the prettiest, neatest, and most symmetrical ventilators made. Its dimensions are given in Fig. 172 as follows Outside diameter *bb* of ring or bell mouth 32 in., inside diameter *aa* of mouth 24 in., height from foot to mouth *dd* 13 in. Now let us suppose we have one of these ventilators to make of the dimensions stated above. We must first mark out the pattern for each section, which are four in number, namely. The back, Fig. 173, the sides, Fig. 174; the saddle or throat piece, Fig 175, and the ring at the mouth, Fig. 176. Now examine Fig. 172 carefully. You will notice the circumference of the circle *A A* is divided into four equal parts by the corners of the inscribed square *A A'*, shown by the dotted lines, and you see this measures off the size of the two sides, the throat and back, at the mouth, and the same at the foot *CC*. First, then, we see the back, Fig. 173, is one-fourth the circumference of a twenty-four inch circle wide at the large end *ee*, and one-fourth of a twelve inch circle at the small end *gg*, that is, $\frac{24\times3.1416}{4}=18.8464$ at *ee*, and $\frac{12\times3.1416}{4}=9.4248$ at *gg*, and forty-five inches long at *ff*, and the radius *h e* of the arc *e f e* twenty-four inches, now add enough on each side for riveting, as shown by the dotted lines, and the pattern for the back is complete. Second—The pattern for the side is shown in Fig. 174, and is laid out as follows: Continue the dotted line *bb*, Fig. 172, and at right angles to it draw *a' e* Fig. 174. From the point *c*, on *a e*, lay off *c a'* and *c a*, making *aa'* equal to one-fourth of a twenty-four inch circle, or 18.8496. From the point *e*, with a radius *e a* equal to 4.70 inches, describe the arc *f a*, making it equal to 57 degrees from *a* to *f*. From the point *g* on *f e*, continued with a radius *g f* equal to 23.5 inches (or five times the length of *e a*) describe the arc *f h*, making it equal to 14.25 degrees. Erect on *g h* the tangent *h u*, making *h u* equal to 10.5 inches, and draw *u o* parallel to *h i*. Now make *u o* equal to 9.4248, or one-fourth the circumference of a twelve-inch circle, and divide *u o* equal in *X*, and erect the perpendicular *x u*. Now lay off on *a'a* the distance *a d* equal to 13.30 (that is, 12.75 or—*a d* Fig. 171—multiplied by 2 then by 3 and divide by 5.75 thus, $\frac{12.75\times2\times3}{5.75}=13.30$) and from *d* through *u* and at right angles with *t' X* draw *d s*. From the point *d*, with a radius *d a'* equal to 13.30 inches, describe the arc *P M*, making it equal to 84 degrees from *M* to *P*, join *M O*. From *s* with a radius *s a* equal to twenty-four inches (or the diameter of ventilator mouth), describe the arc *P A*. Now add enough on each side, as shown by dotted lines, for riveting, and the pattern is complete.

Third. The pattern for the throat or saddle, Fig. 175. Continue the dotted line *dd* (Fig 172) through *x y*, Fig. 175, and at right angles to it draw *w v*. From the point *u* on *w v* lay off *u v* and *u w*, making *w v* equal to one-fourth of a twenty-four inch circle, or 18.8496. With a radius of twenty-four inches describe the arc *W X V*. From *X* on *X Y* lay off the distance *x t* equal to eleven inches, and draw *r s* at right angles to *x t*. From the point *t* lay off *t r*, *t s* making *r s* equal to one-fourth of a twelve-inch circle, or 9.4248. Lay off *r p* equal to four inches and complete the parallelogram *r o*. Now add on to the sides enough for riveting edge, and the pattern for the saddle, Fig. 175, is complete, ready for forming.

Fourth. The pattern for the ring, Fig. 170. Let *a b c d* represent the curve of the mouth ring (Figs. 170, 171). Unroll the wire edge as shown at *a* and *c*, Fig. 176. Now through the points *a* and *b*, *c* and *d* where the curve begins from the riveting edge and ends at the turn of the wire edge, draw the lines *A O C O* and let them meet in *O*. From the points *e* and *f* on *o b* lay off the length of the curve or width of the ring toward *a* and *c*, then with a radius *o a* describe the arc *c a g h* and make it three times *a c* in length, and with a radius equal to *o e* describe the arc *f e n i* and join *f c* and *i h*. Now add on the riveting edge parallel to to the ends as shown, and the pattern *f c a g h i* is complete. It should be noticed here the arc *c a g h* is four and one-half times the radius, which measures off 270 degrees. This gives the pattern when formed up a pitch half way between the two fashions called lantern-head and hood, Figs. 153, 154.

We will now proceed to work these several parts up, and commence by filing all the edges smooth to free them from rough burrs or cracks, if any, made by the shears. In Fig. 177 is reproduced a photograph, in which is shown the several parts of a model ventilator, made to a scale of one and a half inches to the foot, and then taken apart and photographed especially for this article; each part is therefore shown exactly as worked up from these patterns, and as they should be before riveting together. Now take the ring pattern, Fig. 176, and after riveting together take it to a mandrel of the proper size, and with a suitable mallet or hammer work out a course at the small end; then turn it up and work out a course at the large end, and be careful that the blows are even and at regular intervals. Now hang it on the mandrel and work in a course from the outside, and continue the courses first inside and then outside until the necessary curve is obtained (this is shown by the dotted elipse in Fig. 171), annealing at the close of every three courses; when planished smooth, wire the edge with a quarter rod and the ring is complete. The back, Fig. 173, is next. Make of a stiff iron rod a template of the outside bend of the back, and also of the curve at each end. Turn or bend the pattern to the shape of the long template, and wrinkle the two edges regularly the length of the bend, then take it to a hollowing block, Fig. 21, having a suitable hollow in it, and proceed to hollow the back evenly until it has curled round and is one-third smaller curve than it was before, permitting the wrinkles to come in regular and even.



Now commence to work the wrinkles out, first from the inside in the block, then from the outside on a cod with a razing hammer, Fig. 33. When the required shape has been obtained, smooth and planish, and proceed with the saddle, Fig. 175. First bend a wire template to the curve of the throat, *A C*, Fig. 171. Now bend the saddle pattern, Fig. 175, lengthway a third smaller curve than the template, take it to an anvil, Fig 4, and with a razing hammer, Fig. 33, raze down the outside edges of the saddle, then work in a course from the inside toward the middle of the pattern; then work a course along the edge *w x v* of the pattern and anneal. Continue the process until the curves conform to the templates, then proceed with the sides as follows. Bend each side a sixth smaller curve than they are intended to be when finished, similar to the directions given for working Fig. 28, turning one to the right, the other to the left, then turn the throat edge in a course on an anvil or suitable mandrel to begin the forming, then turn the outer edge up a course and wrinkle at regular intervals, as shown in Fig. 29, and take it to a hollowing block and hollow the side, letting the wrinkles come in regularly until it has curled enough, then work the wrinkles out, keeping close attention as it proceeds to fasten it at the point when nearest the shape required. To guide or assist in this the throat and back may be bolted on to the ring, and also to a twelve-inch hoop at the small end, and the sides fitted to them. When the sides are formed, and the seams all lay true, punch the edges intended to lap on the outside, and place them in position again to mark the holes of the inside edge, then rivet and scrub the seams so that the surface inside is all smooth. Now fit the ring tight inside the mouth, rivet up and finish.

HEADLIGHT REFLECTORS.

Headlight reflectors are a nice job when properly made. It should be noticed, Fig. 178, the curve or shape of this article is that of an hyperbolic conoid. This curve has been adopted so that the rays of light from the lamp may be thrown to a greater distance than could be done if they were made spherical When the lamp is placed so that the flame stands in the focus of the curve, the reflector has its greatest power and efficiency. There are two ways of making this reflector, namely By raising it from a solid disc, Fig 179, or by cutting a pattern for a frustum of a cone, and working it to the curve after being brazed together, Fig. 182. We will make one each way. First, we will raise one up from a disc, and will suppose, as in Fig. 180, it is desired to measure 22 inches in diameter at the opening *A B*, with a flange ¼ inch wide and 16 inches deep from *C* to *D*. Now we want to know the size of a disc of sheet copper it is necessary to have that we may raise up this reflector and have it the proper size when finished. This we obtain in the following manner. In Fig. 180 the distance from *E* to *F* is 7 inches, from *G* to *H* 22 inches, and the slant height *F H* 17.75 inches, here, then, we add the diameters of the two ends together, and divide by 2, which gives 14.5, or the mean diameter; multiply this by 3.1416 and divide by .7854 to convert into disc inches, now add the square of 7 inches or the diameter of the small end, and extract the square root of the sum, and we have the diameter of a disc whose surface is equal to that of the frustum *G E F H*, excepting the surface of the base, thus $\frac{7+22}{2}=14.5$, the mean diameter, then $\frac{14.5\times3.1416\times17.25}{.7854}=1029.5$ and $1029.5+49=1078.5$, the number of disc inches in the sides and crown, and extracting the square root of this sum we have $\sqrt{1029.5+49}=32.84$. Cut out a disc of sheet copper 32¾ inches in diameter, Fig 179, and divide the diameter into four parts *a b c d*. With the radius *a b* describe the circle *b c*. Now wrinkle the edge regularly all round, forming the pan, Fig 181, and take it to a gibbet shank, Fig. 133, or to a suitable mandrel at the block, Fig 122, and proceed to raze down the wrinkles with a razing hammer, annealing at the conclusion of every course. Continue the operation until the required pitch is obtained, and the small end is 7 inches in diameter, then on a bullet steak in the block, Fig. 137, break down the corner or lag to the curve, and true up to shape, then at the anvil *A*, Fig 131, lay off the flange. The job is now ready to planish and smooth.

We will now work up one the other way and give it the first form by brazing the pattern together, as a frustum of a cone, *G E F H*, Fig 180. To obtain this pattern draw *A B*, making it 22 inches, and divide it equal at *D*. Erect the perpendicular *D O*. Now lay off the line *D n* 15¼ inches, and draw *L F* at right angles to *D n*. With a radius *O F* describe the arc *J F L*, and with the radius *O H* describe the arc *K G H I*, then *W K G H I L* is the pattern required. Cut out the pattern and thin the two edges *K W*, *I L*, and cramp one of them; now fold them as in Fig 103, and hold it together with four dogs as shown, close down the joint smooth with a hammer and chatter to loosen it, now sling with a chain to a traveler, charge with a reed and run the joint.

When cool, clean off the joint and knock it down, so as to make the joint the same thickness as the sheet, and anneal. Now round up smooth with a mallet and stag in the lag and cramp in the crown, Fig. 182, and after brazing smooth up the joint as before directed. Now break down the lag and true up to size and shape as before. I find that all reflectors that have come under my notice are plated either with nickel or silver, but it would seem to me that if they were tinned and planished in the grain they would last longer and cost less.

In closing, if these articles shall be the means of guiding or rendering the assistance needed by the boys of the trade, who may be struggling along holding a position in which they are anything but welcome, or if they shall afford a hint to those men willing to learn something from the experience of others, although they may have no immediate use for the information offered, then the purpose of the writer has been attained.

The Franklin Institute, of Philadelphia, have awarded the Edward Longstreth Medal of Merit to Wm. F. Mattes and John F. Lewis, inventors of the Lackawanna lubricator, for devising a lubricator which their committee says, "* * * for simplicity and perfect working under varied conditions is proven to be in advance of its competitors."

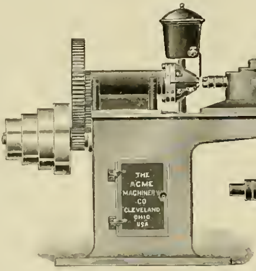
The new Union Station at St. Louis is said to be the largest and best arranged in the Union. The building is a handsome stone structure, the train shed, covering thirty tracks and ten acres of ground. The entire cost of the site, tracks and buildings was $6,500,000. It was opened for traffic on September 2d.

A New Nut-Facing Machine.

This machine has many new and valuable improvements over others made heretofore for chamfering and facing nuts and bolts.

The cutting head is arranged to hold three tools made of bar steel, one for facing, one for chamfering the corners, and a third to remove the first thread in the nut. They can be removed, ground and replaced in a few minutes.

The spindle to which the cutter head is attached is driven by a four-step cone pulley and geared 4½ to 1, thus having sufficient power to face the large nuts with ease, and the additional advantage of facing the smaller sizes at the proper speed.



On the carriage is mounted a turret with a broad key to keep it in line, and a lever nut to clamp it in position, as shown. The carriage is moved forward to the cutting head by means of a cam journal on the ways of the bed. This cam is driven by a worm and worm wheel, thus giving the carriage a steady forward movement, and the weight hanging from the front end of the bed returns same after the nut has been faced.

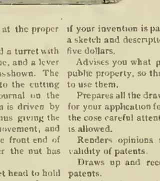
The advantage of a turret head to hold the nut arbors is that the nuts can be removed and replaced much quicker and with less exertion than is possible on a machine where the arbors revolve and the cutting head remains stationary.

This is one of those time and money saving machines with which old lathes cannot compete.

The name of the builders is shown on the cut.

The Johnson Stay-Bolt Cutter.

The illustration accompanying this article shows the construction of a splendid tool for cutting off stay bolts after same are screwed into boiler.



The tool was gotten up some four years ago at the Kingston, Pa., shops of the D., L. & W road and has been in constant use there ever since.

It puts no strain whatever on the bolt being cut—simply shears it off. It is light and easily handled—twenty-five bolts having been sheared off in one minute with it.

This cutter leaves the bolt projecting $\frac{3}{16}$ of an inch, just right for heading over, and two sizes of cutter dies are furnished with each machine—for ¾ and 1-inch bolts

The tool is made and sold by the Henry C Ayer & Gleason Co., Philadelphia, Pa.

What a Patent Lawyer Does

We are often asked about employing patent lawyers, and what they do for clients. The following answers to that question we take from the card of a patent lawyer, Mr. Geo. P. Whittlesey, of Washington, D. C. They tell the whole story in a nutshell :

Sends you a copy of the Patent Laws and Rules of Practice free.

Sends you printed copies of patents at low rates.

Advises you whether the new device you are proposing to use is an infringement on any patent now in force.

Examines the office records to find out if your invention is patentable, if you send a sketch and description of it and a fee of five dollars.

Advises you what patents have become public property, so that you are at liberty to use them.

Prepares all the drawings and documents for your application for a patent, and gives the case careful attention until the patent is allowed.

Renders opinions upon the scope and validity of patents.

Draws up and records assignments of patents.

Searches the records of assignments and makes abstracts of title, showing the present owner of any patent.

Conducts suits at law and in equity against people who infringe your patent.

Defends you in court from patentees who sue you for alleged infringements of their patents, or, in case you have other lawyers, looks up the state of the art to get material for the defense, and testifies as a patent expert.

The price of Mushet's steel has been reduced on account of the tariff. The "special" brand now sells at 46 cents per pound and the "Titanic" brand at 19 cents.

The B. & A. engines mentioned in last paper as having steel pistons, will have Taylor Yorkshire iron pistons—the standard of the road.

Dangerous Locomotives—If Injured, They Scald!

BY GEO. S. HODGINS.

Some years ago the editor of *Punch* gave the English people a very good method for reducing the frequency of accidents to excursion trains. The advice was given after a disastrous wreck on the London, Chatham & Dover Railway, which road, by the way, was referred to as the "Leave 'Em, Smash 'Em, and Turn Over Ry." The proposal was simply that upon the buffer beam of each excursion engine a director of the company should be tied, and that said director should make the entire trip in that position. The satirical, though humorous, proposition nevertheless embodied an often-overlooked truth. It is, that those responsible for defective system, management or appliances do not, as a rule, share the risks that they thereby impose upon other servants of the company.

Locomotive runners, *i. e.*, engineer and fireman, of more than nine-tenths of all the locomotives in use on this continent have daily and hourly to take risks which to the lay mind appear simply appalling. In the event of serious damage or the wrecking of the locomotive they may be boiled alive. The policy of reduction of this kind of unnecessary risk to these men, not only would benefit them as a class, and would be dictated by a humanitarian instinct, but would also secure a dollar-and-cent advantage to the company following such a policy. It would at the same time render the transportation of the traveling public correspondingly safer, because passengers run a similar though less probable risk of being scalded as do employés, and the consequent immunity from accident and death in this terrible form could be made the basis of truthful advertising, and it would also materially reduce the large amounts annually paid as indemnity to injured travelers, or to sorrowing friends.

The locomotive of to day is supplied with a most efficient brake apparatus—air pump, governor, whistle signal, etc.—by an outside manufacturing concern. The same engine is equipped with two trustworthy and carefully constructed safety-valves, supplied by an outside firm. The steam gauge is also of approved pattern and supplied by special manufacturing firms outside of the railway itself. The injectors used are various in kind and excellent in design, and are procured ready-made in open market. The regular, constant and satisfactory lubrication of the main valves and pistons is also the result of the adoption of sight-feed lubricators made by outsiders. The heating of passenger coaches is also accomplished by the use of appliances of outside origin. We have, therefore, six most useful appliances or sets of appliances, placed upon engines at the present date, not designed or made by the railways themselves. This fact has led many to believe that the mechanical superintendents and others engaged in the manufacture and maintenance of locomotives are willing to wait for some outside agency to supply the necessary protective appliances for the fast-running locomotives of the future. There is, however, no reason why the railroad mechanical world should rest content or patiently put up with dangerous engines, waiting until some deliverer arise in the shape of an outside company with patent rights and royalties to be bought and paid for. The mention of a few points will justify this statement. There are many such points apparent to any thinking man who will carefully and seriously consider the question of how best to protect the locomotive runners and the traveling public in case of serious damage to engine or train If steam and hot water can with certainty be kept in the boiler of a wrecked locomotive, this part of the problem will be solved.

In the first place, both boiler checks should be placed inside the circumference of the boiler, or out of the way of any possible contact with obstacles or wreckage. They should be so placed as to automatically close in the event of the delivery pipes being torn off. The safety-valves should be protected by some strong shield, which would bear the brunt of a collision, or the tearing action of wrecked cars or coaches being thrown upon it, or be able to withstand the shock if the engine itself should turn over. In all these cases the shield should be able, as far as human foresight could predict, to protect the safeties and prevent them being torn from their seats. A circular boiler-plate shield, slightly coned towards the top and open at the smaller end placed on the dome, easily removable by the withdrawal of a few bolts, might afford a protection of the utmost value. The blow-off cock should also be provided with some suitable inside valve, which, when the outside case has been torn off, would automatically close the dangerous opening.

The Chicago and Northernwestern Railway is using on some of its engines a protected blow-off cock, designed with an inside valve, acting as a check and intended to close if the exterior parts were accideotally broke off. The water-gauge glass and try-cocks should be, if possible, combined, as is often done on stationary boilers. They should be so arranged as to require only two openings into the boiler, and each opening to be provided with a suitable inside valve capable of promptly closing in an emergency which had carried away the whole of the boiler mountings. A more difficult matter would probably be the arrangement of the turret. It should stand in a comparatively protected position behind the dome. It should be provided with an inside valve which would at once seat, in the event of the turret being broken off and a purposely weakened portion might regulate the line of fracture. Steam is drawn from the turret by pipes for the two injectors, the blower, the air pump, the steam gauge, the coach heater, the lubricator, the bell-ringer, and should also supply the whistle, and by so doing reduce all these openings into the boiler to but one.

Many of these pipes have steam passing through them intermittently, and consequently cannot depend upon any automatic action unless the turret itself be destroyed. In the event of an injector steam pipe being torn off while the injector is working, the inside top check would prevent the escape of boiling water, but steam might still flow from the uninjured turret.

A fractured air-pump steam pipe might also pour out live steam without any chance of shutting it off, if access to the turret was not possible. The opening in the dome of the steam pipe which supplies the turret should be fitted with a throttle-valve similar, though of course smaller than the one for supplying the cylinders. It should be held open by a bell crank, lever and stem; the latter should pass through the boiler-head in the same manner that the main throttle-stem does, and come out just above it. The handle should be so arranged that by simply throwing it out of a single catch or notch, the valve in the dome would promptly close, as a double-faced valve will do if the upper area is much greater than the lower. By this means, at the first approach of danger a fireman could shut steam off completely from all the boiler mountings as rapidly and as surely as the engineer shuts off steam from the cylinders. With the main throttle closed, and the turret throttle closed, the engine might go into a collision with no boiler openings liable to exposure but those which would be instantly blocked by the automatic action of inside valves. Firemen and engineers would readily learn the value of such an appliance, and failure to operate it would not often be laid to their charge. Even after, or during the wrecking of a locomotive the handle might be thrown out of the detent and so close the dangerous apertures, and the chances of this being done are much greater than is the case now with ordinary globe valves.

The present position of railroad mechanical engineering in this respect may well be contrasted with a kindred mechanical art. In the science of gunnery an improvement was at one time made in the method of giving rotative motion to projectiles while passing down the rifled bore of a cannon. It consisted in the substitution of a gas check instead of brass studs on the sides of shot and shell which followed the grooves of the gun in passing out. The gas check consisted of a copper saucer placed at the base of a projectile, with concave surface towards the powder chamber. When the shell began to move under the pressure of the powder gas, the edge of the saucer or gas check would be pressed outward and so cut sharply into the grooves of the rifled gun. The center of the saucer having been previously made to engage with corrugations in the base of the shot, a rotary motion was thereby imparted to the smooth missile without the use of studs or lead coating. The advantages gained were full utilization of the pressure of the gas, as none could blow out of the gun, over or around the projectile at the moment of firing and before its inertia had been overcome. The gas check also lent itself more readily to the increasing twist, which had been found so advantageous a system of rifling. When the shot left the gun, the gas check flew off sideways or in any direction, its work being done. This very erratic flight of the gas check was at once recognized as a dangerous thing in case artillery were protecting an advance of infantry or covering a retreat. In firing into an enemy's camp over the heads of allies, the gas check was found to be a source of uneasiness, as the fire from a battery might almost be as disastrous to friends as to foes.

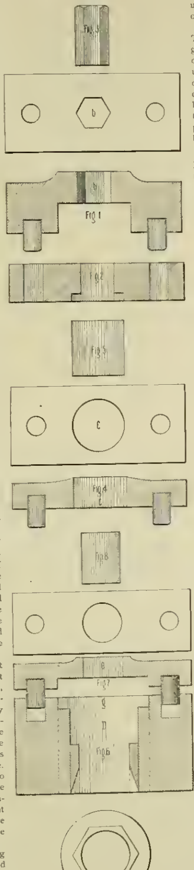
With this before them, artillerymen did not go on for years firing projectiles with loose gas checks in the vague hope that none of them would fall among friends, or if they did, that the casualties would be few and far between, or because none of the bombardiers themselves could be injured. They saw the menace to the life of fellow-soldiers, and a remedy had to be provided. The gas check was made a fixed appendage to the shell when firing, and though the corrugated and rough edge somewhat increased the resistance to the flight of the shell in the air, it was retained sooner than place friends even under the shadow of a possible mishap.

This illustration points to the fact that in a kindred mechanical science a defect noticed or a source of danger discovered, is a danger removed. Not so in locomotive engineering to-day. There are many intelligent, thinking men now in the employ of every railway and locomotive works who are capable of designing some simple and effective protective appliances along the lines roughly indicated above. There are many humane managers who would welcome such improvements. These men would be set to work, if sufficient interest could be aroused, and that without waiting for some outside deliverer to arise or subjecting railway directors to the fate of Mazeppa.

The Pennsylvania Railroad is now using a patented inside boiler check of improved design which adds to the boon of safety the probable advantage of cheaper maintenance. The trenchant words of LOCOMOTIVE ENGINEERING may well be quoted in conclusion: "Half the fatalities of railroad wrecks and more than half the tortures can be prevented if steam can be kept in the boiler." This subject has a mechanical, a humanitarian, and a "dividend-paying" aspect, capable of interesting alike the workman, the philanthropist, and the managing director.

Forging a Hex. Nut with a Collar.

This ingenious set of dies is in use on the St. P. & D. road, and were made by Foreman Blacksmith Geo. F. Hinkens, secretary of the Master Blacksmiths' Association. Many large nuts are required with a solid collar on one side, such as are used on front end of piston rods on many engines.



In Figs. 1 and 2 are shown the dies. The larger opening is hex., the smaller opening round.

The first operation is to cut out the hex. blank. This is done by placing the iron on Fig. 2, used as lower die, putting the guide cap, Fig. 1, on top, the guide pins keeping it in proper place. Then punch, Fig. 3, is placed in guide cap, a rap of the hammer punches out the blank.

In the next operation Fig. 2 is reversed; the cap shown in Fig. 4 is used, and upsetting punch shown in Fig. 5 used to upset the blank, thus forming the collar on the end of the nut.

The next operation is punching the hole. This is done with another set of dies altogether. The blank is placed in Fig. 6, opening shown at D, guide cap, Fig. 7, is used, and punch shown in Fig. 8, the top of the cavity in Fig. 6 is round, for the collar; the part at D is hex., for the nut, but the die edge below is round to cut out the hole, this die is made of a separate piece of steel and put in loosely from the bottom.

A very strong and striking example of English ignorance of American institutions is seen in a full-page picture in the *Illustrated London News* of September 29th. The picture illustrates the late forest fires in Minnesota, and represents a locomotive dashing at full speed through the flames. From a railroad man's standpoint that locomotive is the funniest thing the unconsciously humorous English journalist has perpetrated in a long time. The engine has an almost perpendicular cow-catcher, has no headlight and no bell, and has a fat, bulbous smokestack like a Japanese vase, such as has not been seen in this country for thirty years or more. The steam dome is very English, and has the English horizontal lever on the top. The cab is one of those shallow English shelters with bull's-eye windows in the front, and the reversing lever is in the middle of the cab, right in front of the furnace. The engineer, who has a sou'wester hat on, and looks like a lone fisherman, is pulling the lever with his left hand, and the fireman is sitting on the right hand seat instead of the left hand seat, where he ought to be. When the prominent position of the *Illustrated London News* in the world of illustrated journalism is considered, no American can fail to see what a perfect example of crystalized English ignorance of things American this picture is.

Sometime ago an item appeared in this paper to the effect that the Leach Sanding Device people were manufacturing models to be placed in air-brake school cars, or rooms for instruction purposes. The call for these models from engineers' and firemen's clubs has been so great that they are in danger of financial embarrassment, and respectfully decline to send more to these clubs unless they are paid for the cost of manufacture, which is $5 each.

The Board of Trustees of the Field Columbian Museum, of Chicago, has appointed Willard A. Smith honorary curator of the transportation division of the department of industrial arts.

The Cleveland Twist Drill Co. writes "It seems to us that business is steadily improving. We are running our full complement of men ten hours per day, and have been doing so for some time." This is the kind of news that is heard all along the line now—it cannot be overdone.

H. O'Neil, the photographer, who sold photographs of the "999," has gone out of business. Orders for these should be sent direct to F. W. Blauvelt, 247 Ninth avenue, New York.

The fine new two-revolution press that prints this edition of LOCOMOTIVE ENGINEERING, has cast into its frame this legend "Remember, oil is cheaper than iron." That motto would be a good one to put up in some locomotive cabs—and also some master mechanics' offices.

"Comfort in Travel" is the title of a handsome little illustrated book just issued by the Passenger Department of the Michigan Central. It's an artistic job throughout.

The Elements of Boiler-Making—VIII.

SHEET-IRON WORK.

By C. E. Fourness.*

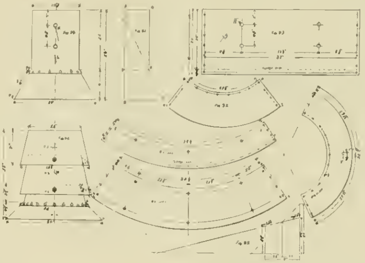
PLAIN PETTICOAT PIPE.

I will now proceed to lay out a plain petticoat pipe, Fig 90, flare 16 inches in diameter at the bottom and 6 inches high, waist 10 inches in diameter and 12 inches high. Total height of pipe 18 inches First draw a center line, *A B* Fig 91, then a base line *B C* 8 inches long, which is one-half the diameter of the base of the flare. Next draw *D E* 5 inches long 6 inches above, and parallel to *B C*. Draw a line through *C* and *E* and extend far enough to cut the center line *A B* at *F*, this makes an outline view of one-half of the flare or cone. Draw a line *E G* parallel to *A B* and 12 inches up from *E*, this represents the waist.

I will now lay out the waist Draw a line 12 inches from the side of the sheet that is to form the top of the waist, and at this line the waist is to be flanged. Draw another ½ inch down from that, or 12½ inches from the top edge; this line is for the holes, and still another line ½ inch further down, that is to shear on. This allows the lap. Draw two lines for the straight seam, one ½ inch from the end of the sheet, and at right angles to the other lines already drawn Draw the other line parallel to the last, and 31 inches, the circumference of the pipe, apart. Allow ½ inch for lap outside of this line, and then proceed to space off six holes in the straight seam, leaving the top hole 1 inch from the top edge of the sheet, and the bottom ¾ of an inch above the line For flanging, space off fourteen holes for riveting to the flare, but only punch the corner or lap holes when punching the straight seam before rolling, for if these holes along the flange were punched before flanging, the sheet would crack out from the holes, and the holes would all pull out of shape in flanging, so just center-mark them, so as to be able to find them. After flanging, also drive a rivet in the lap hole, and it will keep that hole fair and make the sheet draw equal all around. After flanging, punch the holes where centered, and it will go onto the flare nice and straight. I have seen men in fitting a waist to a flare after flanging, and not having the holes marked, look around quite some time for a place to set the flare down alongside of something heavy, and get a long stick for a pry to hold the waist down to place; then after the helper had slipped the waist back and forth several times, and perhaps had fallen down in trying to hold it steady in place, as he would have to bear all his weight upon the pry, the boiler-maker would reach away down and mark off the holes ready to punch.

I will now finish the laying out of the waist by laying out the holes for the bolts that hold the hangers to the pipe As the hangers are exactly opposite, I will do this by dividing the sheet into one-quarter, by spacing or by division, $31 \div 4 = 7\frac{3}{4}$ inches this is the distance from the straight seam, and 15½ inches the distance apart of the holes. Then the top holes are 3 inches from the top and the others 4½ inches lower. (See Fig. 93.) Now for the flare. Take the trams and set them to the distance, *F C*, Fig. 91. This distance I carry to the sheet of iron, of which I wish to make the flare, and draw an arc *H I*, Fig 92, with that radius, where it will cut with the least waste. Preserve the center *J*, Fig. 92, from which this arc was drawn. Return to Fig. 91 and set the trams to the distance *F E*, and with this radius from the center *J* draw another arc *K L*, Fig. 92. From the same center *J* draw another arc *M N* ½ inch from *K L* for the rivet holes. Next comes the line for the straight seam. Set the straight edge to the point *K* and the center *J*, and draw a line to cut through and between the arcs *H I* and *K L* Measure off on the line *K L* 15½ inches, if the flare is to be made in halves or of two pieces, or 31 inches if it is to be made of one It is customary to make them in two, as there is not so much waste of material in cutting Measure off 15½ inches on line *K L* with a flexible rule, or mark that length on a thin strip, and use this to measure with and mark the point *L*, and through this point draw another line from the center *J* for the straight seam. Allow ½-inch lap outside of these lines for the holes for the straight seam. Lap and space off the holes in the straight seams for four rivet holes, counting the corner hole, and leaving the bottom rivet at least ¾ inch from the edge. Next, the rivets to attach the waist. Space this off for eight rivets, one-half the number in the waist, counting both lap holes. Center-mark the holes, and one-half is ready for punching. After shearing and punching, this part can then be used as a pattern to mark off the other half, or it can be laid out similar to the first.

*Foreman Boiler-maker, C., M. & St. P. Ry., Dubuque, Iowa



FLOUNCE PETTICOAT PIPE.

The following is a flounce petticoat pipe, made up of three flares bolted together with three ⅜-inch bolts with thimbles or distance pieces 1 inch long between the flares at each connection. The two upper flares are similar, but the lower flare is made up of two pieces riveted together, the lower part having the most opening. First, on any convenient piece or sheet of iron draw an outline view of the pipe, showing all the flares in position same as Fig. 91. Only be careful that you allow the thickness of the iron right, as the thimbles are on the outside of one flare, and inside on the other, and if everything is allowed all right the outfit will go together without any pulling, hauling, pinning or forcing Perhaps it would be best for most men, instead of making an outline to make a sectional view to show the thickness of the metal used, then they can get exact dimensions.

It is the same in this as any other thing, when a person knows exactly what he wants he will need but very few lines to find what he needs. When drawing the sides of the flares, continue the line till it cuts the center line at *K* for No. 2, *L* for No 3, and *M* for No. 4, Fig 94.

Now for the flares Set one leg of the trams or dividers to *L*, Fig. 94, and the other to *H*, the top of the No 3 flare.

I will now set the one point from *L* to *K* and *J*, and I find the other point just touches the top of those flares. Consequently, I can use that radius for all. I now, on the sheet of which I am to construct the pipe, draw the two arcs, *C D* and *E F*, lines to shear on to form the tops of the flares Nos. 2 and 3.

Preserve the centers from which these arcs are drawn. Next set one point of the trams at *K* the other at *G*, then set one point in the center, from which I drew the top of the flares Nos. 2 and 3, and draw an arc or line *G H*, No. 2, and *I J* No 3, for bolt hole. No. 1 does not require this line. Again set the trams to *K F*, Fig. 94, and draw another arc, *M N*, on No. 2 flare. No. 3 does not require this. Set the trams to *K I*, Fig. 94, and with that radius draw *Q R*, the bottom of the No 2 flare. Set the trams from *L* to *N*, Fig. 94, and with this radius draw the arc *S T*. For flanging on the No. 3 flare, again draw an arc, ½ inch outside of *S T* for the rivet holes, and another one for the lap ½ inch outside of the line for the holes

What is needed next is the circumference. These three flares are 11 inches outside, $11 \times 3\frac{1}{7} = 34\frac{1}{2}$ less ⅜ of an inch equals 34⅛, the length. To locate *C D* and *E F* this distance, 34⅛ inches apart, draw the lines for the straight seams through these points and pointing toward the center, from which the arcs were drawn, space off the straight seams of No. 2 for four rivets, leaving the end holes 1 inch from the top and 1 inch from the bottom of the flares, and after drawing a line ½ inch outside of and parallel to the holes in the straight seams, the first two flares are complete, except the holes for bolting the flares together, three bolts being required ⅜ of an inch in diameter for this purpose, with distance pieces or thimbles between Nos. 1 and 2 and Nos. 2 and 3 respectively.

To find these holes divide the circumference 34⅛ inches by 3, this equals 11⅜ inches, the distance apart of the holes. But as the straight seam is to be midway between two of these holes, divide the 11⅜ inches by 2, which equals $5\frac{11}{16}$ the distance. The first holes are to be located from the straight seam, and the other hole is 11⅜ inches from these holes already located. Mark these points upon the line or arc *C D*. Then take a straight edge and set one end to the center from which the arcs were drawn, the other to the point just marked on the arc *C D*, and on this flare make short marks across the arc *G H* and *M N*, this will be the center of the bolt holes on that flare.

Mark off three holes for bolts on the arc *I J* No 3 flare same distance from the seams and apart as they are on the arc *G H* No 2 flare. Now for the rivet holes to rivet No. 3 flare to No. 4. Space off the arc drawn for the rivet holes on the No 3 flare for twenty holes and center. Mark them good, then space off the straight seam for four holes. After this is accomplished these three flares are complete and ready to shear and punch, but as in the waist, Fig. 93, only punch the lap straight seam, and $\frac{7}{16}$ holes for bolting together. Leave the last seam on the flange of the No. 3 flare till after flanging, then punch for the No 4 flare. Set the trams to the distance, *M N*, Fig. 94, and with this radius draw the arc forming the top of the flare No. 4 One-half inch inside of this arc draw another arc, upon which to punch the rivet holes.

Set the trams again to the distance *M O*, Fig. 94, and with this radius draw the arc *U V* forming the bottom of the flare of No. 4.

Now for the circumference. The bottom is 20 inches in diameter outside, $20 \times 3\frac{1}{7} = 62\frac{3}{4}$ inches, less ⅜ inch, equals 62⅜ inches. But as this is made in halves only one-half or $31\frac{3}{16}$ inches needed.

This length lay off on the arc *U V*, and at the points *U* and *V* draw lines toward the center or radiating from the center For the straight seams which space off for three holes, space off the arc drawn for the rivet holes, eleven of which are required on each half to rivet Nos. 3 and 4 flares together. The hangers to hold up the pipe are attached to this flare, and as they are opposite each other they will require to be on a line radiating from the center one-half the circumference apart and one-fourth of the circumference from the straight seams $62\frac{3}{8} \div 4 = 15\frac{19}{32}$, the distance from the straight seam. There are two holes in each hanger 1 inch apart, and on a line 1 inch from the bottom.

The No. 2 flare can be used as a pattern to mark off the No. 1, only leave out the three holes for bolting together at the top as they are not needed.

Fig. 95 is the outline of the flares Nos. 3 and 4, No. 3 being extended down the bottom line, which makes it similar to Nos 1 and 2 flares, with the distance the bolt holes are from the top and bottom marked upon it as shown, is all that is required to lay out the pipe after a man knows what he wants.

British Railway Men.

(EDITORIAL CORRESPONDENCE.)

When one connected with an American engineering journal goes to Europe he naturally supposes that the kind of railway machinery which he sees will provide the best subjects for writing about. The descriptions of things, strange and novel, are likely to be interesting, but the difference between American track, bridges, signals and rolling stock has been so thoroughly discussed that I thought our readers would be more interested in the "personnel" of foreign railways, and accordingly I devoted considerable time and attention to the human part of the railway systems abroad. Most of us, after all, sympathize with the sentiment of Dr. Johnson, the famous lexicographer, who, on being invited to drive into the country, refused, saying, "One field looks just like another let us walk up Fleet street and look at the people."

One of the first things that strikes an American railroad man when he goes to Europe is the great number of men about stations dressed in uniform that indicates they are railway employés. I stood around Euston Square station, in London, which does about the same business as the Grand Central station in New York, and it seemed that there were ten railway men to be seen for one on our side. When the list of men employed doing clerical work is examined, it is found that the number in Europe greatly exceeds those employed on American railways doing a similar volume of business.

The conditions of railway service all over Europe are much more permanent than they are in America. When a youth begins to work for a railway company he expects to remain on the line all his life, just the same as those who enter government service; and on most lines he expects to be pensioned when he grows old.

Many men remain the whole of their working life at the same occupation, but the greater part of the men rise to higher positions than those they began with. In the early years of railway existence the higher positions were almost invariably filled by men who had commenced in the lower ranks, ability alone having been the power that worked them upwards. That state of affairs has gradually changed, and promotion is gained to great extent by family connections or influence. This is a sore subject with the men in the lower ranks, but most of them admit that being a nephew or cousin of a director will not keep a man in a responsible position unless he has the ability necessary to perform the duties satisfactorily. The men who fill the positions equivalent to our managers, superintendents and train-masters are now generally taken from the clerical departments. Formerly trainmen often reached the positions mentioned. Now a youth with influence behind him begins work as a clerk, and from that he is promoted to be a station master at perhaps a small station. Here he gains valuable experience which prepares him for taking charge of a larger station, where he learns enough to take a position near the general manager. A station master is a much more important personage on a European railway than he is in America. On some of the Continental lines he is dressed finer than a drum-major, and puts on more airs than a city marshal.

In the British Isles the locomotive superintendent, who is head of the mechanical department, is nearly always a practical mechanic, who has risen through the grades of pit foreman, shop foreman and the progressive steps in that line which lead to the top. He holds in every European country a much more independent position than that held by most mechanical superintendents in America. He is responsible only to the directors for the way his department is managed, and is no more under the control of the operative department than they are subject to him. It is the same with the head of the permanent way, buildings and bridges.

The men who run locomotives are treated with much more consideration in Europe than other workmen, but the engineers and firemen on most of our roads would think themselves very badly treated if they were subject to the rules in force abroad. The pay of firemen varies from 75 cents to $1 25 a day, according to locality and character of service. An engineer gets from $1.25 to $2 per day. Mileage receives no consideration. A first class mechanic receives about $1 25 a day. A day is 12 hours for a trainman, and a man is not entitled to overtime until that length of day is exceeded. With express trains enginemen frequently make over 300 miles a day. A Government department called the Board of Trade exercises control over railway operating, and reports have to be sent in daily of the number of hours that all trainmen, switchmen and others have been on duty. If men are kept out more than 12 hours there are certain to be demands for explanation.

Persons who wish to become engine drivers in Britain now invariably begin work as wipers. These are taken on as boys. When a fireman is wanted the oldest wiper is taken, but before being advanced he is examined in reading and writing and in eyesight. The oldest fireman is promoted, as a rule, when an engine driver is needed, but he is examined regarding his knowledge of the work to be done. The examination relates to engine and brake mechanism and to firing—little different in fact from the examinations given to firemen on our roads.

The enginemen as a class do their work very well, and a system of premiums for saving of oil and fuel, which is general, makes them very saving in the use of supplies. I had the privilege of riding a good deal on locomotives, and was surprised to find how skillfully the firemen did their work. I rode from Glasgow to Carlisle on the engine of a Caledonian Railway express train of twelve carriages, and both the firing and the handling of the engine were as near to perfection as anything I could conceive.

I shall postpone my remarks about the condition of railway men on the Continent of Europe to another letter.

A. S.

The Fastest Regular Train

Trains have been running all the past summer on the Philadelphia & Reading railroad between Philadelphia and Atlantic City and return, which were the fastest trains ever run regularly on any railroad. The trains were not of the two or three car variety which is generally arranged for fast runs, but were composed of six or seven heavily loaded cars, the average weight of train being 411.7 tons. During the month of August these trains were run every day by engine "694," a four-cylinder compound of the Vauclain type. The average speed from start to stoppage for the whole month was 59 1 miles per hour.

The engine which made this remarkable record is of the same type and general dimensions as the celebrated "Columbia," that attracted so much attention at the World's Fair. She has two pairs of drivers and a leading and trailing pony truck. The driving wheels are 7 feet diameter and are set so that the main rods connect with the hind pair. The boiler which has the Wootten firebox is straight, 54 inches diameter, and gives 1,478 square feet of heating surface.

The peculiar wheel arrangement produces a finely proportioned engine, with a good distribution of the weight. The leading pony truck equalizes with the leading pair of drivers and the trailing pony truck equalizes with the back drivers. There is no equalizer between the drivers. The engine rides very well indeed.

The Long & Allstatter Co., of Hamilton, O., report that business is improving as rapidly as might be expected. They are making particularly good tools for manipulating plates, and the demand for the same is increasing. In the railroad trade their great stand-by is the "bulldozer" for forcing metal into shapes for structural work. The hard times have been peculiarly favorable to this tool, for they have compelled railroad companies to use the scrap heap as stock for repairs. The "bulldozer" is a great help in making this kind of stock into useful entities.

The Bridgeport Machine Tool Works, owned by E. P. Bullard, has been incorporated into a company hereafter to be known as the Bullard Machine Tool Co. Mr E. P. Bullard is president, H. A V. Post is treasurer, and A. H. Bullard assistant treasurer and secretary. The same line of tools will be built—and they build good ones.

The Niles Tool Works, at Hamilton, O., are running full time with rather more than a half force of men. Business is improving, but orders from railroad companies are very scarce. They have lately built some exceedingly heavy tools for government work, and they have now in the shops very large tools for contract shop work.

Bement, Miles & Co., machine tool builders, of Philadelphia, have opened a New York office in the Taylor Building, No. 39 Cortlandt street, and have placed E. H. Mumford, recently with Henry R. Worthington, in charge.

The Cleveland Twist Drill Co. have been awarded a gold medal at the Antwerp Exposition for fine tools.

? A. What You Want to Know. ? A.

Don't ask questions that simply require a little figuring to determine; make each question separate. No notice taken of anonymous questions.

(140) J. McNally, Halifax, N. S., writes

1. If a locomotive reverse lever is drawn up to the center notch, does the valve move, and if so, how much? *A.*—The valve moves to and fro to the extent of the lap and lead. 2. How can I calculate the area of a steam port? *A.*—Multiply the length by the breadth.

(141) D. P., Aurora, Ill., asks:

Is it possible for an engine to slip ahead when shut off and running fast? Detailing a case. *A.*—This question was discussed *pro* and *con* a year or two ago. We were very skeptical about it, but many good men testified that it had actually occurred with them, and some explanations of the slip laid the trouble to the counterbalance and to engine being out of quarter.

(142) S. B., Quasqueton, Ia., writes

How do you find the pressure on the shell of a boiler? I should think that it would be that part of the shell out of water multiplied by the pressure per square inch, plus the surface of the water multiplied by the pressure also, heads not included. *A.*—The total pressure on the shell of a boiler is found by multiplying the circumference by the length, and the product by the pressure. The height of the water does not cut any figure.

(143) P. D., Paducah, Ky., asks

What is the best "dope" to clean a headlight with? *A.*—Alcohol and lampblack. Put enough of the latter into a fair sized bottle of alcohol to make a thin paste. Wipe this on the deflector, from the center to the edge (never 'round and 'round), the alcohol will cut off all smoke stains and immediately evaporate. When the lampblack is dry wipe it out with a clean piece of waste and you have a clean reflector with the least possible work, and without danger of scratching the reflector.

(144) S. B., Quasqueton, Ia., writes

On page 48 of "Progressive Examinations" is the following "Q. Suppose, after pitching over (summit), you had only a "flutter" in the lower gauge cock, what would you do? A. Keep supplying water, but instruct fireman to keep fire bright, to prevent flues from leaking." If he didn't keep fire bright, why would the flues leak? *A.*—When the engine approached the summit her fire was forced to its hottest, and the flues were expanded to their greatest length. If the draft is stopped and the fire allowed to die down and the water in the boiler cooled by introducing cooler water, the flues will contract, move in the tube sheet—and leak. A clean fire prevents, in a great measure, differences in temperature (and, therefore, differences in length) of the tubes.

(145) A. L. B., Monett, Mo., writes

1 In Grimshaw's "Locomotive Catechism," page 24, we have "Q. Suppose that a firebox has on it a pressure of 160 pounds per square inch and that the staybolts are 4 inches between centers, what will be the strain on each bolt? A. There will be 16 square inches held by each bolt making 19,600 pounds that the bolt will have to hold." Please explain in your information column how this amount is obtained, giving reasons for each step. *A.*—If the bolt supports a load of 160 pounds per square inch and there are sixteen square inches on it there would be a strain of 2,560 pounds instead of the enormous load quoted, which is, perhaps, a typographical error. 2. Also, please state what disposition was made of the Erie engineers' locomotive after the exhibition at the World's Fair? *A.*—It is now at the shops of the builders, The Cooke Locomotive & Machine Co., Paterson, N. J. We understand that it is for sale.

(146) C. S., San Francisco, Cal., writes

I should like to ask you a few questions in regards to safety angle valves for air brakes. I've got an idea of an arrangement that could be very cheaply applied to any angle valve at present in use; but it would act as follows. In case any cock on a train became partly closed, my valve would automatically set all brakes on the train; but if cock was closed altogether, only a portion of the brakes would be set. Do you think this would do in case of an emergency? It might also happen that only the brakes on engine or tender would be set, or perhaps only on the last car, depending on which cock was turned? Will this do? *A.*—We do not think so. There are already too many devices invented to take the place of the angle valve. All the improvement necessary or desirable (if such is an improvement) is a cock that will let the air out of the train pipe if turned wrong. There are now about thirty patents out on cocks for doing this.

(147) H. F. B., Owosso, Mich., writes

Please give me a simple rule to find the proper size of steel and number of plates to put in a spring when the weight upon the drivers is known. *A.*—The width and thickness of the plates are decided arbitrarily. Springs 36 inches long have generally plates $3\frac{1}{2} \times \frac{3}{8}$ inch. Shorter springs may be only 3 inches wide. Some springs are made $\frac{1}{2}$ inch thick, but $\frac{1}{4}$ inch makes a more durable spring. After the length, width and thickness of the springs have been settled, the number of leaves to be used can be calculated thus. Multiply the load in tons of 2,000 pounds which the spring has to carry by the length of the spring in inches, and multiply this by 11. This is product one. Then multiply the width of the plate in inches by the square of its thickness in sixteenths of an inch. This will be product two. Divide product one by product two and the quotient will give the number of plates required. Suppose a spring 30 inches long, with plates 3 inches wide and $\frac{3}{8}$ inch thick, has to carry a weight of 5 tons. According to the rule given we figure $\frac{5 \times 30 \times 11}{3 \times 6^2} = 15.3$ which shows that fifteen leaves would be about right.

During the floods that happened in a Western district last fall, a passenger train was caught in the water and the fire of the locomotive quenched. The railroad officials did their best to prevent the passengers from suffering, and got them taken back to terra firma as promptly as possible, all the hacks of a neighboring town having been used for the purpose. In wiring the news of what was done there was a slight mistake made in spelling a word, and friends of the passengers were rather alarmed to read that the flood caught the train and the passengers were taken ashore in *sacks*.

The Southern Railway Company expect soon to begin equipping the new machine shops at Knoxville, Tenn., with the machinery required to put them in working order. All the heavy repairs required for engines running on divisions within easy reach of Knoxville will be done in the new shops.

"Thumb Nail Railroad Cyclopædia" is the title of a little vest pocket folder we have just issued. It contains more information than ever before crowded into so small a space. Your club raiser will give you one.

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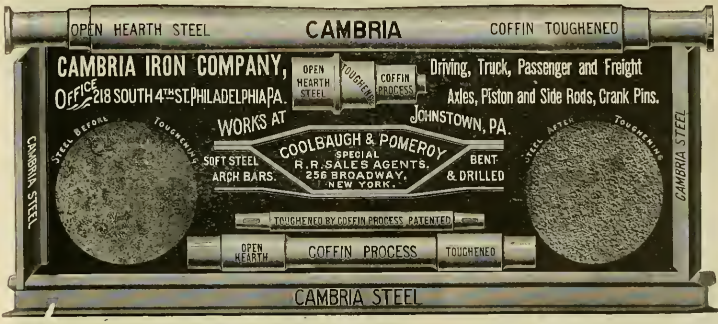

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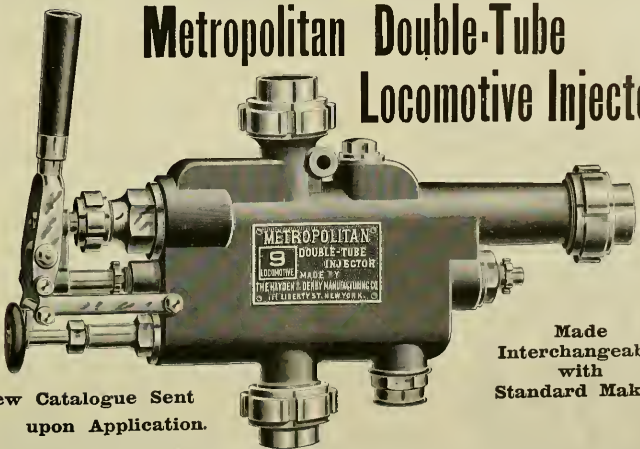

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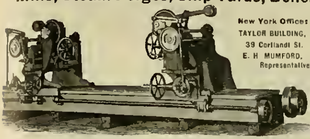

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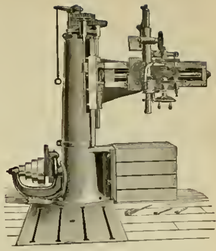

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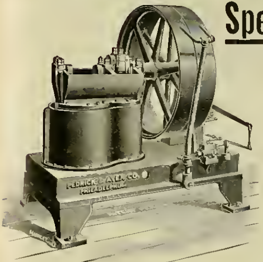

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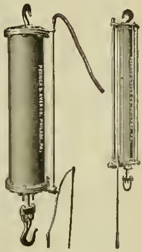

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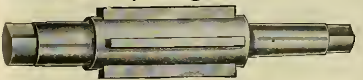

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VOL. VII, No. 12. NEW YORK, DECEMBER, 1894. 20 Cts. Monthly $2.00 Per Year.

Let in the Daylight.

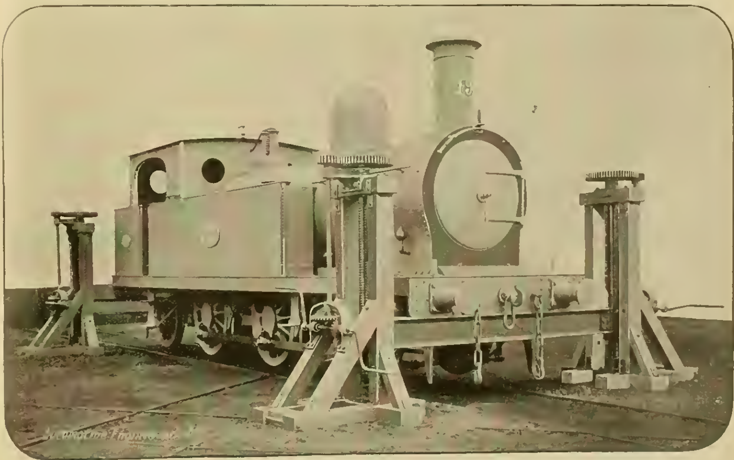
About a year ago the writer happened to walk through the shops of a railroad not noted for providing the best of facilities for doing work, and he was struck with the dark and somber appearance of the machine shop. The windows were small and some of them were shadowed by other buildings, the effect being that at mid-day artificial light had to be employed in some parts. The walls and posts and rafters were as black as long years of smoke anointing could make them. We suggested to the master mechanic that a coat of whitewash would improve the light of the place and enable the workmen to labor to better advantage. It had never struck him that white walls would improve the light, and when the philosophy of the thing was explained he readily fell in with the idea. We visited the shop lately and it looked like another place. An apparatus had been improvised to do the white-washing by compressed air, so that the work was done at little cost, and the walls were not permitted to become dingy. The M. M. spoke in the highest terms of the benefit they had derived from the increase of light.

This incident recalls the fact that in many shops the advantages that arise from good lighting are not properly realized. When the light is so obscure that a workman must use a torch or common oil lamp, the chances are that his capacity to perform work is reduced one-quarter. On some jobs it may be greater, on others it will be less. Every man in charge of mechanical work is aware how much the dark days of winter reduces the output common in summer, when good sunlight is enjoyed through the whole working day. It is common for railroad companies to work short time in summer and full time in winter, which is very poor policy, for the long hours are worked when production is done at the greatest disadvantage. That this practice is so common is a proof that those in charge do not fully realize the advantages of good light.

Dark shops represent a double line of waste which furnish strong arguments in favor of light. If the light of heaven is not freely admitted artificial light must be employed, the cost of which is money thrown away. Darkness reduces the capacity of the workmen and tools so that the work is done at greater expense. Black walls and shadows from adjoining buildings are not the only things that make shops expensively obscure. Many of them have been built as if the admission of light were not an important matter, so the windows are small and badly located. As these are considered of small importance no effort is made to keep them efficient. They are never cleaned, and when a pane of glass is broken the hole is filled with a shingle, a piece of tin or lump of waste. This condition of affairs is not rare. Those in charge of shops to which this description applies should mend their ways. It is near the first of the year, a good time for forming good resolutions.

To those in need of advice we would say. Apply the whitewash brush or air squirt liberally to walls, rafters and shop posts. If the windows are opaque with soot, dust and cobwebs drench them with strong soap-suds, then turn a generous water sprinkler upon the glass. If the windows are too few, cut holes in the walls and put new ones in; if they are too small, make them larger. Changes of this kind can be made at small cost, and they will be found very remunerative.

During the month of October 3,849,947 passengers rode in the cable cars over the New York and Brooklyn Bridge. This was an increase of 201,894 over the record of the same month a year ago.



Peculiar Form of Screw Jacks Used in Many European Shops

Going Through Normandy.

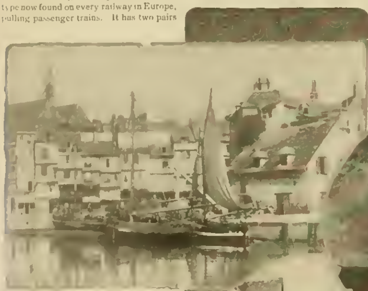
[EDITORIAL CORRESPONDENCE.]

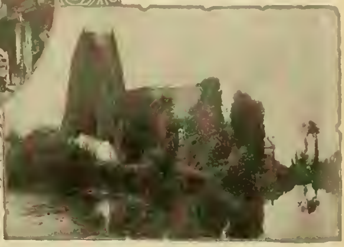
Havre, where my land journey began, is the Liverpool of France, and a striking place, the finer part of the town being built on the face of hills that show off the fine substantial residences to good advantage. The town is insignificant compared to many which a traveler sees in Europe, but to one from America it gives a peculiar impression which is everywhere made deeper—that is, that he has reached a place which is finished. When our cities are as old as those seen abroad, they may also possess less of the developing appearance; but we will have to wait a long time for that. Havre is a comparatively young city for Europe, having been founded shortly after Columbus discovered America, but its position on an excellent harbor at the mouth of the Seine has given it advantages possessed by few of the older towns.

In one respect Havre has a homelike appearance, for the railways go through the town on the level, and the tracks are to some extent used as thoroughfares. As the train was pulling slowly through the town, youngsters of both sexes, clad in little more than native impudence, ran along the side of the cars soliciting money

I happened to have a good supply of copper coins, which I dropped off slowly, and witnessed curious sights in return, as the gamins and gamines rolled over each other in the scramble for the treasure. I felt sad to see the poor wretches. One looks for a good deal of that sort of thing in Europe, but that scene was the most pathetic I witnessed in travels that extended over more than two thousand miles.

The train that took us to Paris was made up of small compartment carriages and pulled by a locomotive that looked very much like the engine illustrated on page 367 of LOCOMOTIVE ENGINEERING of last month. The engine is representative of a type now found on every railway in Europe, pulling passenger trains. It has two pairs





of drivers coupled and a four-wheeled truck. There are differences in details to suit the tastes of the designers or of the men in charge, but the essential features are becoming nearly uniform. In France they use outside cylinders with the valve motion outside of the wheels, as seen in the suburban engine herein illustrated. The same practice prevails to a great extent in all Continental countries. In the British Isles the fashion runs towards inside-connected engines, with every moving part that it is possible to hide kept out of sight.

The cars are finely upholstered and are very comfortable for a short journey, but their shortness makes them jump about a good deal when the train is running fast. There is one thing in which the compartment car is superior to the American type, and that is, it encourages sociality if the right kind of people get together. This struck me on this journey. The train was crowded and there were eight persons in this compartment, only two of whom seemed to have had previous acquaintance, yet we had not been together ten minutes when a general conversation was going on and it was kept up throughout the whole journey. They smoked (after asking permission of two ladies who were present), joked, laughed and told anecdotes and had a tremendous good time considering that they were mostly strangers to each other. There was one man with an exaggeration of the facial peculiarities of the third Napoleon who seemed to be a wit, for he kept the party convulsed with laughter, but I never could catch the point of the jokes, and the best I could do was to laugh with the others. The contortions of his face were, however, funny enough to excite a calf to laugh. A gentleman who sat beside me was very much interested in finding out how the United States compared with the part of Normandy we were passing through, and he gave me a great deal of interesting information about the places on the route. He turned out to be a merchant in Paris. Before leaving he gave me his card and invited me to call.

That, of course, was an exceptional company, as I did not fail to observe during my subsequent travels. You notice the peculiarities of the people in different countries very well by their habits in the cars. The French are the frankest and my own countrymen vie with the English for the place of being stiffest and most reserved. This applies principally to the people who ride in first-class cars. Third-class people, no matter what country they belong to, do not generally act as if they would suffer contamination from speaking to people they were never introduced to.

This Normandy which the Western Railway of France takes us through, is a wonderfully interesting country in many ways. The railway goes through a fine fertile region which is cultivated to draw from the soil all the riches that art, labor and skill can entice. The first part is rolling and we traverse some prettily wooded valleys. Further on we reach the valley of the Seine and follow it or go through its shoulders during the remainder of the journey. The river is very crooked, indeed, and the aim of the engineers who located the railway was to make the latter straight. To do this they had to go through or under the ridges that border the river. Accordingly there are several long tunnels and deep cuttings gone through and the river is crossed four or five times. It is a fine substantial track and the grades appear to be light.

As we spin along we see evidences everywhere of neatness, thrift and industry. Great attention is bestowed upon details. The numberless fruit trees loaded with their kind give evidence of careful attention—they are cultivated to bear fruit and do it. No waste land devoted to raising of noxious weeds. Every centiare is encouraged to produce something useful. With sight of the prevailing industry one can understand how easily France passed through the treasure drainage of the German war indemnity and of the Panama Canal Company. Here for the first time I saw the wheat gleaning that we read about in the Bible. At several places rows of children and women were walking through the stubble, carefully "gleaning" every head of wheat that had escaped the rake.

The people themselves are as interesting as their country. I did not see the Norman cap and kirtle because I was not there on a Sunday or holiday, but I saw many strapping women who no doubt gave these ancient specimens of woman's wear the means of showing off to good advantage. I had read a great deal about the influence Normans had exerted upon the development of the world, and my eyes were wide open to absorb whatever of the curious or the picturesque there was to be seen among the people. They had on their everyday attire, and were going through the ordinary walk of their lives, and yet I could not get rid of the impression that I had seen them all before.

I guess most of us who are gifted with any imagination have looked at scenes human and landscape for the first time that seemed perfectly familiar, giving a little support to weird theories that they were seen in a previous condition of existence. This feeling was very strong on me as I was watching the population of Normandy. Two or three weeks afterwards came back to me recollections of people seen in a pedestrian tour I took through Kent and Surrey, in England, many years ago. I had rambled away from railways and frequented routes, away into pure England, that had shouted for no reform bills, among men and women who would throw a potato at anyone who wanted even the land laws changed, or anything else altered that seemed an inheritance of Englishmen. These people had the same characteristics and the same appearance as the rustics to be seen on the lower banks of the Seine. They were the same race. Their forefathers had probably the aristocratic distinction of having "come over with William the Conqueror."

Those who are familiar with history are aware that there was a time when the whole of Europe was one nation like what the North American Continent would be if Canada and Mexico joined the Union. The great nation of Europe was the Roman Empire. In the day of its might the Roman Empire represented irresistible power. Its iron hand bound together in peace tribes of men who were as ferocious as wolves and as blood-thirsty as tigers, it touched them with a varnish of civilization and taught them principles of obedience, with a respect for law and order. When its time came, this Empire fell to pieces, and its fragments settled down where they could most comfortably exist by peaceful pursuits or by rapine, as taste and inheritance moved. The people who then dwelt in the region now called Normandy were a black-haired, swarthy race who loved ease more than strife. They lived peacefully on the fruits of the bountiful earth and water. But evil times overtook them. Away in the frozen North a fair-haired race had been growing and multiplying, and the struggle for existence was so hard that none but sound stock survived. With all the thinning out that the searching environments brought about, the people kept increasing in numbers till the food supply was unequal to the demands. There is nothing that stimulates enterprise like hunger, and this people who became known as Northmen resorted to emigration.

This practice of seeking new pastures appears to have been the only remedy for over-production of human beings devised since the time when Lot wandered away from Abraham by compulsion and planted his tents in the Valley of Jordan. The greatest safety-valve for over-production of people known since the world began has been the facilities for emigration to America. The Northmen knew how to build ships and manage them, and therefore the remedy for excess of bread-eaters was in their own hands. There was no contract labor law or other law to restrain them, nothing beyond their own sweet will, so they sailed away in search of more room. One of the first places that suited their fancy was the northwest district of France. They immediately proceeded to take possession. Those who were already in the place objected, but their opposition was quickly overruled by means of spears, swords and other weapons which the Northmen knew how to use by long practice. Immense swarms of these fair-haired emigrants crowded into Gallia Lugdunensis, as Normandy was then called. The new-comers were too busy to attempt learning to pronounce the old name of the country, so they called it after themselves.

The daughters of the soil suited them very well as wives, and no comely damsel was put to the sword. In the course of a few centuries this rich region came to be known even outside as Normandy. The conquered had toned down the manners of the conquerors, and the combination of races had produced a people of splendid vitality. Like a famous Scotchman's dog, they looked very seriously upon life because they could never get enough of fighting. It was not long when they in their turn needed more room, and a certain chief called William was prepared to lead his warlike followers to new territory. England was badly governed by contending factions, and the leaders had not acquired the art of controlling men. William of Normandy intimated that he wanted to rule England, and to prove his sincerity took an army of his friends and followers across the channel, smote those who raised objections and took full possession of the country. In doing this he set an example that his successors have faithfully followed when they found a country that needed governing.

I cannot dwell more upon the momentous consequences to the human race that came from this engrafting of Norman-Norseman blood upon the lethargic stock of the native English. It produced a human being who was always jealous of any infringement upon his rights, material or moral, and this individual has been an important element in the conservation of human liberty.

At this point of the narrative the J. P. asks "But what has all that got to do with railroads?" I answer that it has everything to do with them, for were it not for the impulse given to progress and liberty by these Norman robbers, when they put vitality into the barbarian English tribes, the clock of time would have been held back two centuries and the railroad era would still be in the far future.

As we speed along we catch glimpses of quaint-looking towns and villages that have houses which seem to have been finished by a series of after-thoughts. There are many churches of the substantial kind which was a stamp the Normans put upon everything they touched. The Parisians call the Normans greedy and grasping, and make fun of their odd ways, but it would be good for France if all her population had the frugal, industrious habits of the Normans.

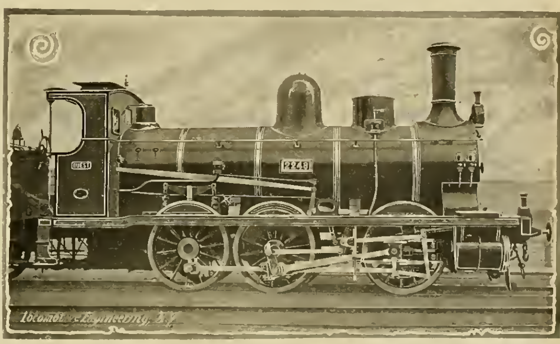
A thing that soon strikes an American traveling on the European Continent is the number of women employed on unwomanly labor. The fields are full of them, we see them driving carts, plowing, loading hay and manure and performing all the toilsome work that we are accustomed to think belongs to man. On this Western Railway of France we find women on guard at all level crossings. At one place, I think it was in Germany, I saw women working on the track. There are very few women employed in offices at the light work for which they are adapted. The usage of barbarism that made warriors of men and drudges of women has not entirely died out in Europe yet.

This Western Railway of France is one of the most important railways in the world. It has over 3,000 miles of double track that twists about through the most populous regions of the country, and does an immense business, the extent of which may be guessed from the fact that 1,494 locomotives are employed handling 4,181 passenger cars and 23,309 freight cars. There are 2,377 men employed repairing locomotives and 2,331 men on car repairs, which does not include an army of cleaners. The nozzle of this immense railway system is the Gare (Station) St. Lazare, which we expect to illustrate soon. It is one of the busiest points in Paris.

I had a personal experience in the neighborhood of Paris the day after my arrival, which may seem funny. It was Sunday morning. As I walked along the fine promenades on the banks of the Seine, I noticed many excursion boats taking loads of people down the river. I am fond of watching people enjoying themselves, so I followed the crowd and got aboard. We passed many places well known to readers of history. The river swept along the base of a low hill beautifully wooded and dotted with fine mansions. As we went on, a town half hidden with foliage appeared and a sign on the landing stage indicated St. Cloud. The place brought back a host of memories connected with events of the revolution of 1789, and I went ashore. I remembered that a very ancient palace here belonged to the ill-fated Marie Antoinette, and I wished to see a place associated with so many historical events.

I hailed a cab and asked the driver what he would charge to take me to the palace. He said two francs and I got aboard. He drove me a long time through some rustic streets and lanes where glimpses of curious old buildings were to be seen, and I kept inquiring for the palace, and he said "Soon." After a time I could see that he was returning, and I kept shouting for the palace. He kept repeating "Pretty soon," or its nearest equivalent in French, until we came back to a square which had been our starting point. Then he said, "This is where the palace was, but it was burne by the Commune and there is no stone o it left!" I felt moved to wrath, but the joke of his action struck me and I laughed at my own simplicity. Then I gave the man a half franc *pourboire*, with the advice that he had better not try that joke on others, especially Scotchmen, for they might fail to see it in s proper light.

A. S.



SUBURBAN ENGINE, WESTERN RAILWAY OF FRANCE.

Block Signaling on the New York Central Railroad.

BY D. B. M'COY.*

The subject of block signaling has been very fully and ably discussed, and very many and instructive articles have been written on it. It occurs to me, however, that some few thoughts that have suggested themselves to my mind might yet be interesting, since they originate from intimate connection with the operating of an admirable system of block signaling.

Block signaling is not of recent origin, it dates back to the early and primitive days of railroading, when engineers used as their block by day the smoke of the preceding engine and by night the reflection of the firebox. There are many engineers in service to-day who will recall that they ran with a greater degree of confidence when they were thus enabled to follow the previous train than when they were without this signal and indication of where that train was. An engineer will run his train with more confidence and safety when he is informed by any method of signals after he becomes accustomed to looking for them, and once established their indication is reassuring. With an engineer who has experience in running under block signals, he will feel as anxious were they taken away from him as though he was obliged to run his train without the air-brake; and I dare say, if the question were asked engineers which they would prefer to be without, could they have only the one, you would find many prefer signals to air. What engineer does not feel an anxiety in starting out on a dark, stormy night, with no signals to show him his track is clear? It is like navigating without the always welcome lighthouse.

The recent improvements in the different systems or methods of block signaling have advanced to such a degree of perfection that many roads to-day are enabled to handle their immense traffic with safety and dispatch, that otherwise they could not do without their system of block signals.

There is no railroad too poor to be without some form of block signals. Even a few block signals that can oftentimes be operated and maintained without any additional expense or cost of operation, after the first cost, would bring a railroad many benefits. These, of course, should be placed at specially desirable points.

Great care should be taken in the location of block signals, so as to command as distant and uninterrupted a view as possible. The three prominent systems now in use on different roads all have merits, viz.: the Telegraphic, the Automatic and the Manual Controlled. With the latter I will deal, and endeavor to explain its functions and the history of its installment on the Hudson Division New York Central & Hudson River Railroad.

The Manual Controlled system is the only one that admits of being operated under the absolute or positive principle of allowing but one train to occupy the block (and, to my mind, this is the only perfect and correct practice of blocking). When it was determined to equip the Hudson division with block signals, after it was decided what system was to be used, the first thing to be done was to locate the different signal towers. This was done with the use of a special engine going over the road, great care being taken in locating the towers to at all times have as far a view as possible of the tower, and at the same time give the towerman a view of the approaching train. After the locations were determined, the erection of the signal towers was commenced at the south end of the division, completing them and throwing them into service consecutively, the engineers and trainmen first being notified to familiarize themselves with the location, and as they neared completion to memorize their location, as far as possible, so that when they were ready to be thrown into service they would know where to look for the signals.

In order to avoid possible confusion, and at the same time not to overtax the memory of the men, it was decided that as fast as five or six towers were completed notice would be given that on a certain date and hour they would be thrown into service.

There being over one hundred towers on the division to equip and operate, it was no simple task to select and appoint qualified signalmen. This was accomplished by having alternates in each of the five or six towers, posting and becoming familiar

*Superintendent Hudson River Division of the New York Central & Hudson River Railroad.

with the duties of signalmen, so that when the next five or six towers were ready to be put in service those originally employed in the first lot were advanced to the next series, retaining the alternates in the first lot of towers, and selecting another lot of alternates.

About every week or ten days we would thus be ready to put into service additional five or six towers, and in this way we continued until the entire division was equipped, interlocked and tied up with blocking. Not a train was delayed or a mistake made the engineers becoming sufficiently well posted about the custom and operation of the first five or six towers were well prepared for the next five or six towers, and so on.

To know that all facing point switches are effectually locked in their proper positions, and that a white signal light is a guarantee that such is the case at night, goes far toward giving an engineer that confidence that all is right which is essential in order to get over the road on schedule time. This is what has been done on the Hudson Division. Interlockings control all such switches, and with the possible exception of two or three trailing ones, every switch on the division is either interlocked or controlled from a signal tower electrically or by means of mechanical bolt locks.

Our signals at block towers, as well as interlocked, are all reinforced by a distant signal, which becomes the important and governing signal. This signal is located about 2,500 feet from the home signal, and with sufficient view by the approaching engineer to enable the fastest train to be stopped before reaching or passing the home signal. It may be remarked by some who have had, or are having indifferent success in operating signals at remote distances that it is impracticable to do so successfully over 2,000 feet, but our experience on the Hudson Division has demonstrated beyond a doubt that signals can be operated a distance exceeding 3,000 feet from the operating lever, and without the aid of an automatic wire compensator. In a number of instances they exceed the above distance, 3,165 feet being the maximum, I believe.

The average for all distant signals on the Hudson Division is in excess of 2,200 feet The theory that distant signals should not be distant from the home more than 1,200 to 1,600 feet, because of the liability of the conditions changing after a train has passed the distant, does not admit of argument, in view of our experience. Theoretically it seems to possess the elements of sound judgment, but in practice there is nothing in it

With the use of the distant signal, trains are enabled, through all kinds of weather, storm or fog, to make their schedule time There have been any number of instances where we have had heavy banks of fog along the Hudson River where our early morning trains were thus enabled to go over the entire division and arrive at the Grand Central Station on time, and in many cases making up time, doing it with perfect safety. Without the use of the distant signal, where trains are as frequent as they are on the Hudson River Road, too much time would be lost in cases of fog in approaching the home signal, and there are many places where, on account of sharp curves, the engineer, in running and making schedule time, cannot see the signal in time to stop before passing it.

SELLERS' ELECTRIC JIB-CRANE, FOUNDRY, BALDWIN LOCOMOTIVE WORKS

During the summer of 1893 we had the fastest trains in the world, namely, the Empire State Express and Exposition Flyer, with any number of through limited express trains, fast mail trains, local express trains, and with a very great number of suburban trains, together with the fast stock and dairy trains, through freights and local freights, many trains running the entire division without making a stop, and oftentimes following each other over the entire division on a two and three minute headway. A superintendent will at once see of what benefit the block system would be in moving this traffic.

With the signals located as frequently as they are, trains can with safety follow each other from two to three minutes apart As an illustration, the Chicago Limited and the Southwestern Limited ran from Albany to New York with seven and eight cars each in less than three hours, and at no time were these trains more than four minutes apart in passing any one given point, and with neither of them stopped or slowed up. This illustrates to what degree of efficiency the block system on the Hudson Division is being operated.

We claim to be pioneers in this country in the adoption and installation of this system of signaling. There were none of us who had any experience whatever with the system, and when it was decided that the correct principle was the absolute block, it was quite a task to introduce it and have the men all educated to operate the road so that at no time would more than one train occupy a block, and to keep all trains moving without delays.

It has been demonstrated without a doubt that with the immense traffic the Hudson Division has, that trains can be run under the absolute block system and make time without any delays.

As the work progressed, and with the operation of several blocks, it was developed from time to time what rules and instructions were necessary and points to be covered. Before the entire division was equipped, we had in use and operation rules and instructions governing the operation of the blocks and movement of trains that are perfectly satisfactory rules, such as the American Railway Association has now been over two years trying to formulate, and they have not yet been able to prepare or recommend a system of rules and instructions. From the experience we have had, and so far as I can see, the instructions that we are operating under cover every point.

The system has now been in use complete over the entire division for about two years, and a great portion of it nearly three years, and from the time the first tower was put into operation up to the present time there have been no accidents or trouble of any kind whatever.

For the first 34 miles out of New York there are forty-four signal towers, making an average of a little less than $\frac{8}{10}$ of a mile between the towers, and 113 signal towers between Grand Central Station and Albany, a distance of 143 miles.

Sellers' Electric Cranes.

During the dull times the Baldwin Locomotive Works improved their works in many ways, the most noticeable improvement having taken place in the wheel shop

Here they did away with countershafts and overhead belting and substituted an electric motor for each tool. These improvements were briefly noted in our last issue. We now present engravings of the cranes put into this shop—made possible by the removal of belts. The photographs incidentally show the application of motors to machine tools

The cranes were built by Wm. Sellers & Co., who furnish the following description

The traveling crane has a capacity of 10 tons, a span of 47 feet 8 inches, and is upon a runway 200 feet long. All its movements, longitudinally, transversely and hoisting, are obtained from a single electric motor carried upon the operator's platform, and actuating the train of friction clutches grouped upon the outside of and towards one end of the bridge. All the movements can be made simultaneously at maximum or varying speeds or independently, at the will of the operator. The load is always automatically sustained, it is therefore never a source of anxiety to the operator. The rates of travel are as follows

Longitudinal, 100 and 200 feet per minute,

Trolley travel, 50 and 100 feet per minute,

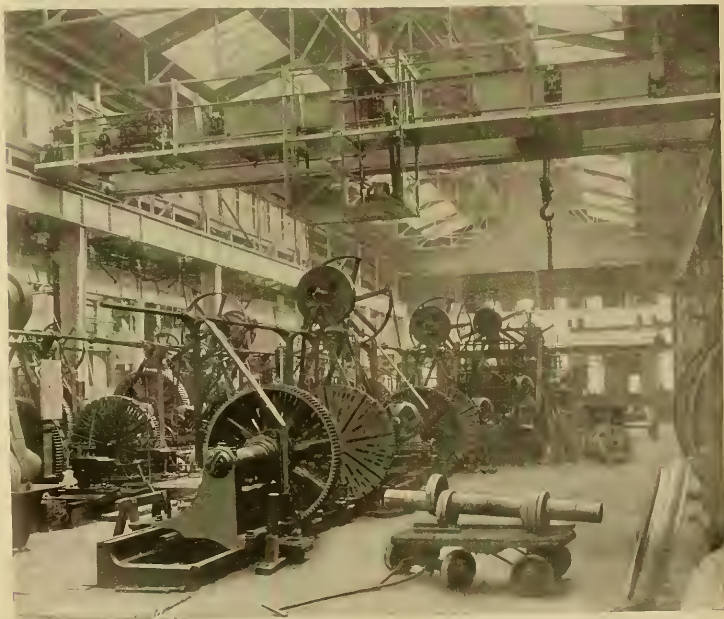
Hoisting and lowering, 5, 10, 20 and 40 feet per minute,

All variable from zero to maximum or *vice versa* without shock.

It will be seen that the trolley or carriage is carried entirely within the bridge, which arrangement permits both members of the bridge to be tied together across the top the full length, thus forming a compound beam and making a very stiff structure in all directions.

The jib or swing cranes have the frame constructed upon the same principles as the bridge of the traveling crane—that is, the carriage is placed within the frame and both members of the crane tied securely together. The absence of the usual diagonal struts, extending from the bottom of the frame towards the outer end of the jib, will be particularly noticeable. In these cranes all the motions are derived from a single electric motor actuating clutch trains upon the same principle as in the traveling crane, and it will be noticed that all the operating machinery is carried upon the back of the frame, placing it out of danger from the load and making it all very accessible.

The crane in the immediate foreground is of 10 tons capacity, and is capable of hoisting the full load at 10 feet per minute or two tons at 40 feet per minute, rack the full load at 35 feet per minute, and rotate one complete revolution per minute. The crane beyond it, and also the one shown upon the ground—not yet erected—have a capacity of 6 tons, and will hoist the full load at 15 feet per minute, rack at 35 feet per minute, and rotate at one revolution per minute. These cranes also have the automatic retaining device to hold the load at all points, and all movements can be made simultaneously at maximum or varying speeds, or independently, at the will of the operator.



SUBSTITUTION OF ELECTRIC MOTORS FOR BELTS AND SHAFTING, AND INTRODUCTION OF ELECTRIC OVERHEAD CRANES, BALDWIN WHEEL SHOP.

An Object Lesson on Jim Skeevers.

Skinney Skeevers has had a hard row to hoe this last year—he's been roundhouse foreman.

Skeevers has been trying for eight mortal months to find out whether he is an "official" or just "one of the hands," and he don't know yet.

He had hardly had time to warm the seat in his little office near "the board" when the company cut the pay ten per cent.—kind o' sudden, like

Skinney had been in one strike, and, being a student of the times, concluded in just thirty seconds by the watch that he didn't mind about the nine dollars the cut took off his monthly check—but he had trouble about it.

The runners commenced to be careless about their work and reported lots of it that they formerly did themselves. Skinney kept after the roundhouse force with a sharp stick and was just about keeping his head level, when the company ordered the shop force reduced twenty per cent.—Skeevers asked for his run again.

The old man refused.

Skinney thought great gobs of think. He concluded to shame the runners into doing something "Jim Loftus," said he, "you don't want the reputation of running as expensive as Crazy Horse Hays. Now, look here, last month your running repairs were higher than Hays' and almost double what they were the same month last year. Now you've reported a set-screw put in front end of your main rod; a machinist will charge up an hour on the '318' for that. Why don't you go into the back shop and get a set-screw and put it in yourself, like you used to?"

"Company pays for puttin' that set-screw in, don't it Skeevers?"

"Yes, but man——"

"All right, Skinney, me boy, if the company kicks about it, tell 'em I'll pay for the time—they ken jest take it out o' the 10 per cent. they took out o' me'"

Skeevers couldn't argue much against that kind of logic. He found the stove committee in a hot discussion, and tried a little reasoning of the general managerial order.

"You fellows know, just as well as I do, that the company is in a hole," said he, "they are losing money hand over fist, and I say it's no more than fair that the men stand some share of it—don't they promise to restore the wages when times pick up?"

"Have you got any notes in your diaree showin' as how the company divided up with the men year before last when we had five months of a coal rush? You know they had a bulge on the price and the freight. What's sass for the rooster is good enough dessert for the hen. Them's my sentiments!" This from Hen. Jorge, one of the oldest and best men on the road

"Youst you vate," said Otto Deitrich, the socialist member, "undil ve ged dot co-oberadive com——"

"Right ye air, Dutchy," said Hank Bitters, "when we git to heaven 'there'll be no sorrer there' In the meantime I set up no more wedges till they pay me three-eighty-five for a hundred miles, see!"

The strike fever got epidemic. Some of Skeevers' men were exposed, and it broke out among the firemen. Dirty Evans refused to wipe off the "113," and Skeevers advised him to go into the fertilizer business—and gave him his time.

Then the whole lay-out took their time—to go out.

The master mechanic ordered Skeevers to send out wipers, helpers and pumpkin huskers from the four corners of the earth to fire engines.

The boilers had chills, the trains were ate—and Skeevers got red-hot letters from the trainmaster.

Skeevers had smoke coming out of 48 per cent. of his mills when the engineers concluded that it wasn't safe to run the engines.

The master mechanic undertook to make up No. 8, and got the "321" off a short rail—then he ordered Skeevers to make it up.

The chairman of the committee told Skeevers he'd be expelled if he did. The master mechanic said he'd be fired if he didn't. Skinney compromised by making up half the train, and then getting off the track himself.

The superintendent said Skeevers was too much in sympathy with "the rest of the men."

The old-timers said they could win if it wan't for "officials" like Skinney Skeevers doin' "men's work."

After the trouble was over the men who got back said "Skeevers was just as nice an 'official' as they ever worked for." Those who didn't get back called him a 'scab."

Skeevers had his tin wedding last month, and the general manager sent him a mantel clock "for faithful and efficient service during the recent labor troubles," and the Knights of Labor sent him a set of engrossed resolutions thanking him for "demonstrating his fealty to the cause of labor in the recent upheaval."

Skeevers is muddled for once in his life and don't just know where he stands. He stated the case at great length to his wife on Sunday last and asked for an expert opinion—she was alarmed.

"Why, bless my soul, James Skeevers," said she, "what's a goin' to happen? This is the first time in my life I ever saw or heard of a thing you couldn't squirm around into one of your infernal object lessons. This is one of 'em, I know; but I can't for the life of me see where it comes in—but you ought to. There's something the matter with your liver, or digestion, or something. Lie right down, dear, and I'll make you some ginger tea—what you want is a good sweat."

One of Fifteen Trains, of Twenty-eight Cars Each.

Explosion of Twenty-seven Boilers out of a Nest of Thirty-two at Henry Clay Colliery, Shamokin, Pa., October 11, 1894.

Report of the President's Commission on the Chicago Strike.

At the time of the railroad strikes last summer President Cleveland appointed a commission to investigate the causes which led to the strike and the conduct of all concerned while the trouble lasted. The commission was composed of Carroll D. Wright, of Washington; John D. Kernan, of Utica, N. Y., and Nicholas E. Worthington, of Peoria, Ill. The report of the commission was published about the middle of last month. It blames the Pullman Company very severely for the harsh and unjust treatment accorded to the employés. Although the Pullman Company tried to make people believe that the works were kept running at a loss through benevolent sentiments, the commission thinks that the evidence shows that it sought to keep running mainly for its own benefit as a manufacturer, that its plant might not rust, that its competitors might not invade its territory; that it might keep its cars in repair, that it might be ready for resumption when business revived with a live plant and competent help, and that its revenue from its tenements might continue. Wages were reduced to an unreasonable extent, but rents were kept at the old figures. The commission thinks that the men were unreasonable in demanding the wages that prevailed before the season of depression, but the conclusion come to is that the arbitrary methods followed by the Pullman people aggravated the workmen into striking.

The American Railway Union is very tenderly treated, none of its acts is censured, and its existence is attributed to the working of the General Managers' Association. This association, the report says, was formed in 1886, and has as members the 26 railroads terminating in Chicago. The impression is conveyed that the principal purpose of the association was to exert more powerful control over the wages and treatment of employés. The refusal of this association to treat with the American Railway Union is called arrogant and absurd.

The remedy proposed for disputes between railroad companies and their employés is in a general way methods of conciliation. An effort should be made to provide certain means for bringing the leaders on both sides of a dispute into a position to reason together. The legal machinery proposed for this purpose is the establishing by law of a permanent United States Strike Commission of three members who would have powers in labor disputes similar to those exercised by the Interstate Commerce Commission in regard to rates. The report concludes:

The commission urges employers to recognize labor organizations, that such organizations be dealt with through representatives, with special reference to conciliation and arbitration when difficulties are threatened or arise. It is satisfied that employers should come in closer touch with labor and should recognize that, while the interests of labor and capital are not identical, they are reciprocal. The commission is satisfied that if employers everywhere will endeavor to act in concert with labor, that if when wages can be raised under economic conditions they be raised voluntarily, and that if when there are reductions reasons be given for the reduction, much friction can be avoided. It is also satisfied that if employers will consider employés as thoroughly essential to industrial success as capital, and thus take labor into consultation at proper times, much of the severity of strikes can be tempered and their number reduced.

Some Hydraulic Engineering Experience.

"I don't know as all the fool mechanics are connected with railroads," said the old-timer, reflectively. "Onct upon a time I hit Leadville, in the far west, out o' a job and lookin' fer anything. I got a job in Frank Gay's machine shop.

"He made a fortune repairin' mining machinery, and in the palmy days how he did hit 'em for the dust!

"I remember one day a scientific cuss who was chief engineer and superintendent of a big mine up Stray Horse Gulch, rode up to the shop like a house afire and commenced to yell fer Gay.

"Their pump was broke down and the mine fillin' with water—git some one up there quick—and so forth.

"They had a big hoisting engine and a independent steam pump that fed the boiler—it was her that was ailin'.

"Sais Gay, 'Major,' sais he, 'it's no use loosin' time fixin' up a broken-down steam pump—takes too long. What d'ye say if I send up an injector? We can git her to work in two hours, and I'll 'low ye $25 fer the old pump.'

"'Will she work?'

"'Every time—and no movin' parts to wear out.'

"'Well, git her up as quick as the Lord will let ye'"

"'You and Thompson go up to the Red Headed Mary,' sais Gay to me, 'and git the best injector we have to work there lively as you know how—don't eat or sleep till everything is runnin'.'

"We put up the biggest injector we had and got things runnin' O.K. that afternoon.

"The super was around awful anxious, and the engineer had never seen an injector. After it was all up, the engineer and the super both worked it to be sure they knowed how, and then the super paid his little old $200 for it and was glad to be rid of the pump.

"On the way home Thompson he sais to me, sais he, 'I'm bettin' that if that scientific cuss makes a test to see how much steam it takes to run that squirt that it'll be the economitist thing in camp'

"'How?' sais I.

"'Didn't ye notis me puttin' a blind gasket in that ere steam pipe joint?'

"'No'"

"'Allas do in sich cases. He's only carryin' sixty pounds of steam and the water company pressure is 105 pounds up there—but keep it dark—there's a boom in the injector business.'"

To Use Hand Brakes at Terminals.

There is talk in the English papers about a curious move being contemplated by the Board of Trade, which has supervision over railways in the same way as our Interstate Commission.

Last year there was rather a serious accident in St. Pancras Station, London, when a train ran into a buffer stop and did considerable damage; but no one was seriously injured. The writer was in London at the time, and learned from railway men that the accident was due to the greasing of the rails by a cargo of herrings which had gone into the station shortly before. When the engineer of the train, whose cars met with the accident, tried to stop the train as it entered the station the brakes did not hold the cars, owing to the condition of the rails.

The principal inspector for the Board of Trade proposes a curious preventive for accidents of this kind. It is no more or less than that trains should be stopped, on entering stations, by the use of the hand brake alone. A provision to this effect means that the automatic brakes cannot be relied on. It is a curious movement on the part of a government official.

As a sort of an echo from the labor troubles of last summer, we have heard considerable talk about the advantage it would be to railroad companies to have their car and locomotive repairs done in large contract shops where first-class tools could be provided and subdivision of labor carried out to its fullest extent, one man being engaged constantly doing the same operation. This plan appears to have great attractions to some people, but there are objections to it which are carefully kept in the background. It would likely work fairly well in dull times when there was not a great deal of business doing, but when locomotives and cars had to be repaired with the utmost dispatch the plan would give annoyance and delay that would outweigh all considerations of expense. When a road can scarcely move its traffic for want of power and cars, the prompt repairing of these is often worth ten times the cost of the repairs. For this reason the co-operation or contract system of repair shops is not likely to become popular or successful.

We have a communication from Mr. J. E. Muhlfeld, Toledo, O., taking the stand that the front ends and cabs of locomotives should be designed with a view to presenting as little flat surface as possible. Reducing this to the lowest possible limit would, he thinks, materially reduce the effect of air resistance. He calls for a discussion of the subject. If any reader can send us facts bearing on the subject we shall gladly publish them, but we do not want any mere theories.

Keep Down the Dead Weight.

In a recent issue we mentioned the fact that Mr. A. E. Mitchell, superintendent of motive power of the Erie line, had directed his attention to reducing the weight of cars by making the metal parts lighter, stronger material being employed to maintain the requisite strength. He took all cast-iron parts off a 60,000-pound car and substituted malleable iron of equal strength, saving 1,100 pounds of dead weight. On heavy double-hopper bottom cars a saving of 1,300 pounds was effected. This is a highly important matter, and one which ought to receive the attention of every man who exercises influence over the design and construction of cars.

The growth of the freight car has not been intelligently controlled. When we walk through a freight car yard and note the weight of cars having the same carrying capacity, we discover differences of dead weight ranging from 1,000 to 3,000 pounds. It may be that the light cars are weak in proportion to their lack of weight, and that the consequent cost of repairs makes them more expensive to operate than the heavy cars; but we are inclined to doubt this, and believe that the extra weight is mostly due to a careless habit of making each part strong enough and then adding 50 per cent. to make sure.

We have frequently heard the expression about members of the rolling stock family. "The thing cannot be made too strong." That was a very safe kind of a sentiment, but it originated in a desire to prevent ignorance from being dangerous. Ignorance was uncertain what power of resistance the article ought to possess, and double the necessary weight was frequently carried so that the strength should be ample. There has been a great deal of this kind of designing done in all kinds of railroad machinery and there is good reason for believing that a process of adjusting the size of parts to meet the requirements would result in lightening both locomotives and cars sufficiently to make important saving in operating expenses.

Another thing that has been handled very injudiciously is the substituting of stronger material for what was reputedly weak. Where even steel has been substituted for cast iron the same dimensions of parts have been in many instances retained, even when there was previously no trouble from breakage. The principal advantage from the employment of steel and malleable iron ought to be the lessening of dead weight, yet that has received little or no consideration. The fact is that the reducing of dead weight has not received the proper attention. Master car builders and master mechanics have been occupied principally with the problem of making cars and locomotives as durable as possible, so that the operating expenses on their side of the establishment should be kept as low as possible. It is time now that the interests of the company as a whole receive attention. Freight rates are too low now-a-days to leave it of little consequence how much dead weight is carried.

Excessive Wear Caused by Babbitt.

In the course of considerable experience with babbitt metal in bearings, we have always found that while the material had useful qualities, its use invariably had the effect of producing very rapid wear of journals. In a discussion at the Central Railroad Club on journal bearings, there was an inclination displayed to favor the use of babbitt which surprised us. Some of the speakers, however, talked about babbitt as we have found it. A report had been made favoring the use for driving boxes of brass gibs with the spaces filled in with babbitt. Soft metal was recommended to reduce the friction between the hub of the wheel and cast-steel driving boxes.

Mr. S. Higgins, of the Lehigh Valley, was against the use of soft metal between wheel hub and driving box. He had found that the soft metal acted as a lap to wear out the wheel hub.

Mr. John Mackenzie, of the Nickel Plate, was decidedly against the use of babbitt metal, which he had used more or less for twenty years. The idea in using it was that it was cheaper than brass. His experience with the alloy was that it caused excessive wear of journals. For some time they used bearings with about 60 per cent. of babbit in strips, and the journals wore from $\frac{3}{8}$ to $\frac{5}{16}$ inch in 400,000 miles. They now use a strip of babbitt only $\frac{1}{2}$ inch wide, which is employed because it helps lubrication.

Mr. Smith was opposed to the use of babbitt for taking up lateral motion. On a division where this practice was followed, 50 per cent. of their wheels had to be taken out and the hubs lined. Once he turned an engine out in a hurry and took up the side wear by running in babbitt, and within six weeks he had to drop the wheels and put in a proper lining.

If any one wishes to test how babbitt causes excessive wear, let him take a driving box and not let the recesses run clear to the end where the babbitt is filled, leaving a small brass section at each end to hold it in. When the wheel is dropped it will be found that where the babbitt rubbed it has worn from $\frac{1}{32}$ to $\frac{1}{16}$ more than with the brass. This induced us to adopt brass.

Simple Tests of Lubricating Oils.

During a recent visit to the master mechanic of a small railroad we found him fuming over a roasting sent in by the superintendent on account of hot boxes. The M. M. insisted that inferior oil was the cause, that he had no control over the quality purchased, and he had no means of testing the quality. Could the scribe show him some way to test the oil? Of course, an oil tester would meet the case, but he could not procure that luxury. Then we suggested sending specimens to a laboratory, but even that was out of his reach. On looking through our note book after returning home, we found some facts about oil which may be useful to this man and to others similarly situated. They were propounded by a celebrated German chemist.

The oil should be perfectly clear and as light as possible. It should not be turbid, which may be caused by the presence of water or other objectionable substances. If the oil be turbid through water, it froths on heating, whereas a turbidity produced by solid matter, such as paraffin, disappears on warming and reappears on cooling. The characteristic feature of all mineral oils is their fluorescence, and the smell must be as little perceptible as possible, and should not increase on warming the oil. It mostly smells like petroleum.

If three parts of oil be shaken with one part of water in a test tube, warmed and allowed to stand in a water bath for some time, no emulsion must appear between water and oil, but the latter stand clear above the water, which should opalesce only very faintly and be perfectly neutral.

If the oil is mixed with a little caustic lye of 1.40 specific gravity, it should not be attacked when cold or warm. Saponification is a certain evidence that the oil is mixed with animal or vegetable fat.

On mixing the oil with sulphuric acid of 1.60 specific gravity, it must not be colored brown, but yellow at the most; otherwise, the resins have not been properly removed.

When spread in a thin layer and exposed to the air for some time its consistency must not change, nor should it become acid on being heated continuously above 150 degrees Fahr. Heated in open vessels it should not give off combustible vapors except at a very high temperature. At a low temperature the oil should not lose its lubricating properties, nor should it become solid at the lowest natural temperature, but merely assume the appearance of ointment.

Another authority on oils gives the following easy method of testing lubricating oils. Place single drops of each oil to be tested upon near the end of a piece of plate glass about two feet long, one end being about six inches higher than the other. The quality of the oil for lubricating purposes is shown by the distance traveled by each drop. Thus, on the first day sperm oil will be found to the rear, but it will pass most of the others in time and retain its power of motion after the others have dried up. A light-bodied oil flows quickly, like water, but soon dries, whereas what is wanted is a good body combined with liquid flow. Many oils have a good body but tend to gum, which will be shown on the glass.

Loaded with Brooks Locomotives for Brazil Central Railway.

Wreck on Southern Pacific During the Strike, Last July.

A meeting of the American Railway Master Mechanics' Association's Committee on Wire Gauges was held in Philadelphia last month jointly with a committee of the American Society of Mechanical Engineers on the same subject. Mr. G. R. Henderson, chairman of the Master Mechanics' Committee, was chosen chairman. The meeting outlined a system of exact measurement to take the place of the confusing wire gauge, and the committees are to recommend it to their respective societies. It is expected that all the other mechanical and engineering societies in the country will adopt the method of measurement recommended.

The Norfolk & Western Railroad Company have in use a table made out in decimals of an inch for use in ordering sheet metal, wire and tubing less than $\frac{1}{4}$ inch in thickness. The figures embrace all the sizes of the Birmingham wire gauges and seven others. The table is quite comprehensive and is likely to be adopted by the various engineering societies as a standard. If that happens, iron gauges will be put upon the market with measuring slots made to conform to the various sizes.

We continue to receive catalogues of goods intended for railroad use that are not cut according to any of the Railway Master Car Builders' standard sizes. This is a very short-sighted policy, for many railroad officers are purchasing cases to hold publications of the standard sizes, and all those that do not conform to this are left out in the cold. Some of the catalogues which are destined to go to the waste basket are gotten up in first-class style, and it makes us sorry to think that a small change in shape would have given them a place in every file of such works kept for reference.

LOCOMOTIVE ENGINEERING

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Seven Years of Age.

With this issue of LOCOMOTIVE ENGINEERING she completes her seventh year.

It wouldn't be modest a bit to tell how old she feels nor how proud she is; she has grown and prospered and done some good, and is altogether happy.

Almost any young lady of her years can be indulged in a new dress on her birthday, and LOCOMOTIVE will have a new outfit complete, from pinafore to garters, when she steps out on the stage of 1895, "goin' on eight years old."

Twenty-four thousand readers have been her friends through thick and thin—and she proposes to extend her acquaintance.

LOCOMOTIVE ENGINEERING was established on different lines and runs under different rules from the average railroad paper, has made a success of living and hopes to attain to a ripe old age. Ah! there's where half the trouble comes in—we figure ahead too far—this paper is living for the present. It will try to be the best thing going in its line and to lead in improvements for the time being. It will try to be the best and "most interesting railroad paper published" for 1895—let 1900 take care of herself.

Growth of the Steam Engine.

The people who interest themselves in the growth of the steam engine are, as a rule, above the average in intelligence, yet there is prevailing lamentable ignorance concerning the development of the most important machine ever put into operation. As questions relating to the invention and evolution of the steam engine are among the most common sent in for answer by our readers, we shall devote a little space to a brief treatise on the subject.

Readers of historical works relating to the steam engine will sometimes find the statement made that the steam engine was evolved from the fertile brain of James Watt and that his attention to the power of steam was first attracted to the subject by seeing the lid of his mother's kettle bobbed up by the steam from the boiling water. That is mere fable. The minds of inquiring men were directed to the possible power of steam more than two thousand years before Watt was born. Several centuries before the beginning of our era that strange, mystic land of Egypt began attracting the wise men of the East, and a great seat of learning was established in Alexandria where a library was formed that was to contain copies of all books of authority in the world. Round this center of knowledge, literature, art and all the known sciences flourished, for learning had patrons in the highest potentates of the earth. How far their knowledge of heat and steam extended is not now known, but it was sufficient to enable some inventor to devise a form of steam engine which turned a globe by the reaction of a jet of steam. This invention was described in the work of Hero, one of the philosophers of Alexandria, who lived about 200 years B. C. The machine was the germ of the modern steam engine, and as a means of converting the energy of fuel into mechanical effort it was more efficient than anything tried until the cylinder and piston combination was invented.

When the wisdom and learning of Egypt and of Asia Minor was crushed out by the savage hand of militarism which dominated the world for many centuries, knowledge of science and of the laws of nature was for a time annihilated. When the new modern civilization began to grow up, the minds of men turned to the problem of converting the elements of nature into working forces for the benefit of mankind. The potential power of running water and of moving wind were utilized to do useful work, but there were insurmountable obstacles in the way of applying these sources of power to many of the purposes where artificial power was greatly needed. Philosophers were aware that heat, as represented by wood and coal, contained untold energy that might turn the mills and carry the burdens of the world; but the supreme difficulty was in finding some kind of harness for the power of fire. Slowly steam was identified as the intermediary between fire and mechanical work, but the next difficulty was in finding some practical method for making steam perform useful operations. Science labored for two or three centuries on the problem of utilizing the power of steam, but none of the savants succeeded in improving on the Egyptian apparatus. They discovered that by filling a vessel with steam and then condensing it, a vacuum would be formed, and this was tried in a variety of ways for raising water, but those who were wrestling with the problem could conceive no method of making steam perform direct mechanical operations. All through the 17th century, the scientific men in every progressive country in Europe were speculating on the possibilities of steam and experimenting with apparatus intended to make it perform useful work. The efforts were not wasted, for they learned how to construct boilers that would withstand high pressure, the safety valve was invented, methods of opening and closing steam vessels were devised, and many exact facts were ascertained concerning the generation and condensation of steam. But they could contrive no means by which the pressure could transmit motion to a solid body. When modern science was practically beaten to produce anything superior to the Egyptian apparatus, a working blacksmith devised the cylinder and piston combination which are the most important members of the modern steam engine.

This achievement took place in England in the first years of the last century, and the principal actor was Thomas Newcomen. The steam engine was developed in Great Britain because there the necessity was greatest for something more powerful than horse or manual labor. The need for something that would pump water out of deep mines brought the steam engine into existence, and the same growing need urged forward the work of improving the engine which Newcomen first put in motion.

His was a surprisingly crude machine. It was really only a cylinder open at the top, to which was fitted a piston with a rod connecting with a walking beam above, a pump rod being at the other end. The steam was admitted below the piston and filled the cylinder. Then a jet of water was injected into the cylinder which created a vacuum and the piston was forced downwards by the pressure of the atmosphere. The pressure of the atmosphere did most of the work, the same as it does in the operating of a vacuum brake. The valves to admit steam and water were opened by hand. The first automatic valve gear was applied by a boy named Humphrey Potter, who wanted to have some time to play while attending the valves. He made an arrangement of cords connecting with the walking beam which opened and closed the valves at the proper time. This improved the working of the engine so much that more substantial valve gearing was soon afterwards applied.

This Newcomen engine was very wasteful in the use of steam, owing to the cooling of the cylinder by the injection of water at each stroke. Of course, the cylinder had to be warmed up again when steam was admitted, and the condensation that resulted was enormous. In spite of this source of waste the atmospheric engine was incomparably cheaper than horse power for pumping purposes, and great numbers of these engines were built during the last century. Most of them were for England and Scotland, but there were few European countries that did not erect some Newcomen engines, and several of them were imported to America. In fact, the Newcomen atmospheric engine was the only steam engine used to any extent during the eighteenth century.

Towards the end of the century James Watt, in Scotland, invented an improvement on the Newcomen engine which essentially consisted in condensing the steam in a separate vessel to prevent the loss from condensation that resulted from the practice of injecting water into the cylinder each stroke. About the same time Oliver Evans, of Delaware, was working on improvements on the Newcomen engine which consisted of arrangements for using direct steam pressure without any vacuum. Consequently, his engine was called the high-pressure engine, as the piston was driven in both directions by steam of much higher pressure than that employed by European engineers, and the exhaust steam was not condensed, but allowed to escape into the atmosphere. Watt and his contemporaries and successors in Great Britain devoted their attention to the development of a heavy, slow working engine elaborated to perform a given quantity of work with the least possible expenditure of coal. Evans was the leader in the construction of a light, fast-working engine that could be made easily and transported at small cost. American inventors and improvers of the steam engine followed the practice introduced by Evans, and the typical American engine became noted for its high steam pressure and high piston speed. Early in this century a few European engineers made use, in a limited way, of the high-pressure engine, but it was not popular abroad. The claim is made that the high-pressure engines that worked most successfully in Europe during the early development period were imitations of Evans' engine. Be that as it may, there is no question that an American inventor worked out the design of engine best adapted for locomotive purposes. When the time for using locomotives came, our engineers did not require to look abroad for models. Cooper's "Tom Thumb," first tried on the Baltimore & Ohio, was in every respect a native engine. Although smaller, as a power motor it was as successful as the "Rocket."

Location of Block Signals.

In his interesting article on the block signals on the Hudson River Division of the New York Central, published in another page, Superintendent McCoy tells of the great care that was exercised in locating the signals so that nothing should obstruct the view of the engineer. This is a detail which has not always received the attention its importance deserves. As the installation of block signals is likely to make great progress in the near future, it is proper that those having charge of locating the signals should have a proper appreciation of the dangers incurred when a signal is placed in a position where it can not be readily seen.

Systems of block signaling have been more universally applied in the British Isles than anywhere else, and their experience and mistakes ought to be of service to us. There were few railroads where there were not signals set in such a position that it would be difficult for the engineer to see them. Complaints would be made, but, as a rule, were unheeded, for those in charge of signals always think that their judgment is infallible. Then after a time the inevitable accident would happen, and the investigation that followed would bring out the truth. It was painful to find the number of cases of this character which occurred for years until the companies learned wisdom from expensive experience. Then the complaints of the enginemen received the attention they deserved. If our railroad companies are wise, they will not only listen to any complaints the engineers have to make about badly located signals, but will encourage them to suggest improvements. This policy may be very profitable in preventing accidents.

A well-informed English railway engineer writing years ago on the defects of signals said: The selection of position and the erection of signals is usually placed in the hands of a separate department, which leaves the locomotive department devoid of control, the duty of the engine driver being merely to obey them. Instead of an intelligent system being adopted and strictly carried out, the drivers on many roads state that the signals are placed here, there and everywhere, some on the wrong side of the line and others where they could not be seen at any distance.

One of the most important requirements is that the signals should be placed on the side of the line that the train is on. If by any chance it is absolutely impossible for a signal to be placed on its proper side, special attention to the fact should be directed by a printed notice. Every station should be provided with a home, distant and starting signal. Home signals should be so placed as to completely protect any train which may be crossing from one track to another or into a siding. Starting signals ought to be placed so that with the longest train the engine will not pass the signal for even a few yards. These are very practical suggestions.

Keeping New Cars Years Out of the Shop.

Two master car builders were exchanging experience at a recent club meeting, and each was apparently doing his best to show that he had risen to the occasion which requires close figuring to make a good showing for his department. One had a good deal to say about improvements in shop arrangement and methods, the other had been devoting his energies to the increasing of the mileage of cars between periods of shopping. As a great record in this line he mentioned that some passenger cars built for the World's Fair business had not yet been in the shop. Both were evidently doing their best according to their lights.

We could not, however, help reflecting that too much energy devoted to keeping new passenger cars out of the shop is liable to represent loss of effort. We are inclined to think that after, say, 50,000 miles' running it would be sound policy to take in the car long enough to have the rods and bolts examined and the nuts tightened and strains adjusted. The best of seasoned wood is not always employed in car construction, and six months' usage in our dry climate causes shrinkage which has to be compensated for or the car as a whole will suffer. There are also seasoning cracks in paint and varnish after the first six months of service which ought to be filled up if the wood is to be made long-lived. The trucks should also receive a careful overhauling and have all loose parts tightened up. A few days work applied at this period of a car's history will have an important effect in promoting its durability. Little damage will come of its being kept long out of the shop after it receives the first overhauling.

The Past and Present of Car Ventilation.

Those whose taste for light literature inclines them to devote their leisure hours to the reading of back reports of the Master Car Builders' Conventions, are familiar with the fact that about twenty years ago the men representing the railroad car departments attempted to settle for all time the all-exciting question of car ventilation. That was a subject which had been familiar to railroad men ever since one passenger proceeded to open a car window while another person was protesting that the car was too cold already. The man who desires more than his share of fresh air is always an aggressive animal, and he habitually makes it cold for his fellow passengers and hot for the railroad company that fails to provide means for changing the air in a car every three minutes.

We suppose that it was the fresh air agitators who brought the thing about, but be this as it may, there was a perfect furore for reformation in car ventilating about twenty years ago, and the Master Car Builders' Association was made the leading medium for exploiting the agitation. Elaborate reports were submitted to three successive conventions, and the whole subject was discussed from A to Z and several times over again. The subject was discussed from the standpoint of the practical man, the scientist, the man who wants to be let alone in unhygienic comfort, and of the crank who insists that it is better to die of pneumonia than to violate nature's laws of cleanliness. There were learned opinions submitted concerning the nature of gases that contaminate the atmosphere of badly ventilated cars. The dreadful exhalations that exude from a crowded passenger car and the fearful disease germs that are disseminated when air is not circulated rapidly enough, were pictured in a terror-inspiring manner. As the discussions waxed hot the wonder grew that any person ever survived the ordeal of riding for a night in a badly ventilated car. Working in a sewer appeared a healthy occupation by comparison.

The agitation was a season of clover and kind words for the inventors of car ventilating appliances. There was no scarcity of inventors or of their ventilators, and it seemed certain that foul air would have no resting place in passenger cars till the end of time's chapter. The whole problem was figured out to a nicety. It was decided that 2,000 cubic feet of fresh air ought to be supplied every minute to a car containing sixty persons. The inventors of patent ventilators were quite prepared to supply this volume of air every minute, and double it if necessary, but the man responsible for keeping the temperature above the freezing point declared that ventilating on this scale would never work. How could 2,000 cubic feet of air be raised from perhaps zero or below to 70 degrees above, every minute, by two stoves, which constituted the heating facilities of that day? A compromise was effected, and 1,000 cubic feet per minute was settled upon as the volume of air to be admitted every minute. The poison and contamination contained in the other 1,000 cubic feet of air must be endured since it could not be cured.

We cannot estimate the number of patented car ventilators which were permitted to enjoy a brief popularity or were applied to cars on account of this agitation for fresh air, but there were a great many of them. The world notes not how the agitation died down, but it came quietly to an end, and the average car was not disturbed with improved ventilators. The clere-story sashes and the windows were still there, and those in charge waited till the clouds of reform rolled by, and they rolled without making many permanent changes.

It was like going back twenty years when we received a few days ago the proceedings of the New England Railroad Club, and yawned through two long papers on the Ventilation of Passenger Cars, with a profuse discussion thrown in. Although a little sleep-inspiring, the report made us almost feel twenty years younger and imagine that we were listening to another set of men telling how cars ought to be ventilated. They were not always dull, either, in the old days, for we remember one member, describing the patent ventilators, said that they caused such a strong upward suction that straw hats were drawn off the heads of passengers, and they were afraid to admit children into the cars for fear they should be drawn in and stop up the ventilators.

There was a striking difference in the tone of the discussions on car ventilating twenty years ago and now. Then the speakers were noted for the positive views expressed as to how the thing should be done. There was no uncertainty about how the work should be carried out. Every man was positive that he knew all about car ventilation. The only striking difference that we noted after a lapse of twenty years was that all the speakers not interested in a particular invention were extremely non-committal, some even going to the extent of admitting that they did not know anything about car ventilation. To judge by this, our progress has been merely in the direction of letting people understand how difficult it is to change the air in a car quickly and regularly and at the same time keep the inside warm enough to prevent people from catching cold. We fear the problem will not be satisfactorily settled until people's tastes and constitutions are all made uniform.

The gentlemen who presented the papers at the New England Railroad Club had, of course, their own inventions to offer as a solution of the car ventilating difficulty. They had no hesitation in saying that they were prepared to do the business. We only hope that their devices were more original than their arguments. Those who sometimes find it necessary to walk through a train full of passengers, towards daylight, are certain to agree that the need for improved methods of ventilation is real. If anyone can change the air and yet leave the car warm, his invention will be a sanitary improvement worthy of general adoption.

Several of the roads out of Chicago have adopted a new time table plan invented by Corbitt & Skidmore, of that city. All the figures between 6 o'clock A.M. and 6 o'clock P.M. are ordinary type figures, all those figures representing time from 6 P.M. to 6 A.M., are white figures on a black ground. This will surely prevent mistakes between P.M. and A.M., but it does not remove the objection pointed out by a correspondent in this paper last month, and that is that the *outline* of the figures generally used are the same; a 3 looks, in uncertain light on a shaking engine, as much like an 8, or a 5 or a 9, as can be. Figures of the script order do not have the same general outlines and would be a big improvement on the new day and night system—in itself a good thing and a step in advance.

BOOK NOTICE.

Tables of Diameters, Areas, Weights of Cold Drawn Seamless Tubing. Published by O. J. Edwards, Ellwood City, Pa. Price, 50 cents.

This is a little pamphlet of ten pages containing the tables indicated in the title. It would be very useful to anyone having to figure on steel tubing.

PERSONAL.

Mr. W. B. Thomas, general manager of the Augusta Southern, has been appointed receiver of the Atlanta & Florida.

Mr. W. H. Whalen has been appointed general foreman of the Chicago & Northwestern shops, at Jamesville, Wis.

Mr. C. H. Wade has been appointed foreman of West Chicago roundhouse of the Chicago & Northwestern Railway.

Mr. Norman E. Sprowl has been appointed master mechanic of the Central of New Jersey shops at Phillipsburg, N. J.

Mr. George Donahue has been appointed master mechanic of the Mahoning Division of the New York, Lake Erie & Western.

Mr. Frank Shesgreen has been appointed secretary to President Samuel Hill, of the Montana Central, office in Minneapolis, Minn.

Mr. R. V. Miller has been appointed chief clerk to General Superintendent Fagan, of the Kansas City, Fort Scott & Memphis.

Mr. T. W. Ford has been appointed general manager of the La Porte, Houston & Northern, with headquarters at La Porte, Tex.

Mr. Frederick J. Harrison has been appointed general foreman of the Buffalo, Rochester & Pittsburgh shops at Lincoln Park, N. Y.

Mr. George A. O'Keefe has resigned as master mechanic of the Detroit Lansing & Northern and Saginaw Valley & St. Louis roads.

Mr. J. W. Hamilton has been appointed chief clerk to General Manager Farrington, of the Eastern Minnesota, with office at Duluth, Minn.

Mr. James Prendergast, of Columbus, O., has been appointed general foreman of the Baltimore & Ohio shops at Benwood Junction, W. Va.

Mr. E. O. Smith, formerly of the West Chicago shops, of the Chicago & Northwestern Railway, has been appointed general foreman at Belle Plaine, Ia.

Mr. J. C. Clarke has been appointed roundhouse foreman of the A., T. & S. F. at La Junta, Col. He formerly held a similar position at Woodward, I. T.

Mr. J. J. Chappell has been appointed storekeeper and mechanical accountant of the Prince Edward Island Railway, with headquarters at Charlottetown, P. E. I.

Mr. J. L. Butman, of Saratoga, N. Y., who recently leased the Delaware River & Lancaster, is now general manager of that road, with headquarters at St. Peters, Pa.

Mr. W. R. Sweet, master of transportation of the Augusta Southern, has been appointed assistant general manager of that road, with headquarters at Augusta, Ga.

Mr. Z. D. Lancaster has been chosen president and general manager of the Sebasticook & Moosehead, in place of Mr. Wesley Van Wart. General offices, Hartland, Me.

Mr. P. H. McGraw, general foreman of car shops of the Indianapolis Division of the Pennsylvania lines at Indianapolis, Ind., has been transferred to Chicago as general foreman.

Mr. C. C. Burnett, of Southboro, Mass., has been appointed assistant superintendent of the Worcester division of the Old Colony system of the New York, New Haven & Hartford.

Mr. S. D. Chittenden has been appointed purchasing agent of the Carrabelle, Tallahassee & Georgia Railroad and the Gulf Terminal and Navigation Company, with headquarters at Tallahassee, Fla.

Mr. R. T. Goff, formerly acting superintendent of the Jacksonville, St. Augustine & Indian River, has been appointed superintendent of the entire system, with headquarters at St. Augustine, Fla.

Mr. C. W. Huntington has been appointed general superintendent of the Iowa Central, with headquarters at Marshalltown, Ia. He was formerly superintendent of the Des Moines N. & Western.

Mr. F. T. Gates has been elected president of the Duluth, Missabe & Northern, with headquarters in New York. He was formerly private secretary to Mr. J. D. Rockefeller, of the Standard Oil Company.

Mr. Alfred Walter, general manager of the Erie, has resigned, and his office has been abolished. All communications formerly addressed to him should be sent to C. R. Fitch, general superintendent, New York.

We were in error last month in stating that Mr. Willard Kells, of the Erie, had been appointed master mechanic. The advance he received was having his jurisdiction extended over the car department at Meadville.

Mr. Joseph Herrin has been appointed superintendent of the Western of Alabama and Atlanta & West Point, with headquarters at Montgomery, Ala. He was formerly superintendent of the St. Louis & Iron Mountain.

Mr. Samuel T. Fulton has been appointed assistant to President Nettleton, of the Kansas City, Fort Scott & Memphis, with headquarters at Kansas City, Mo. He was formerly chief clerk for General Superintendent Fagan.

Mr. C. A. McAlpine, superintendent of the northern division of the Old Colony system of the New York, New Haven & Hartford, has been appointed superintendent of the Providence division, with headquarters at Boston, Mass.

Mr. Walter T. Rupert, heretofore foreman of locomotive repairs of the Detroit, Lansing & Northern and Saginaw Valley & St. Louis, has been appointed acting master mechanic of those roads, with headquarters at Ionia, Mich.

Mr. W. O. Sprigg, heretofore master of transportation of the Staten Island Rapid Transit, has been appointed superintendent of that road, with headquarters at St. George, S. I., and the office of master of transportation has been abolished.

Mr. Leslie McLachlin, formerly connected with the Wabash, has been appointed master mechanic of the Kansas City, Osceola & Southern, with headquarters at Clinton, Mo. He will have charge of the machinery and car departments.

Mr. S. G. Dickerson, division superintendent of the Seaboard Air Line at Abbeville, S. C., has been appointed superintendent of transportation, with headquarters at Atlanta, Ga., and the office of division superintendent has been abolished.

We received a pleasant call last month from Mr. John Warwick, purchasing agent of the Chicago Great Western Railway. Mr. Warwick sailed with his wife and children on the *New York* November 21st, to pay a visit to Scotland, the land of his nativity.

Mr. E. B. Wiseman has been appointed supervisor of the Shamokin division Northern Central. He has been assistant supervisor Philadelphia and Erie division of the Pennsylvania Railroad and acting supervisor of the Shamokin division of the Northern Central.

Mr. A. McDonald has been appointed superintendent and Mr. H. W. Anderson mechanical foreman of the Prince Edward

Island Railway, in place of Joseph L. Uosworth, deceased, whose title was superintendent and mechanical superintendent. Headquarters, Charlottetown, P. E. I.

Mr. H. C. Barlow has been elected president of the Evansville & Terra Haute Railroad. He was formerly vice-president and general manager. The writer spent an evening with Mr. Barlow about a month ago and found him one of the best informed young railroad managers he had ever met.

Mr. Charles H. Schlacks has been appointed assistant general manager of the Denver & Rio Grande. Mr. Schlacks is the son of Mr. Henry Schlacks, superintendent of motive power, and has been for many years private secretary to Mr. E. T. Jeffery, now president of the Denver & Rio Grande.

Mr. James Meehan has been appointed superintendent of motive power of the South Carolina & Georgia Railroad, in place of Mr. E. M. Roberts, resigned. Mr. Meehan is one of the best-known master mechanics of the country, having been long at the head of the mechanical department of the Queen & Crescent system.

A paragraph has gone the rounds of all the railroad papers to the effect that Mr. William N. Bannard, of the Pennsylvania Railroad, had been appointed superintendent of the Buffalo division of the New York Central. There is no truth in the statement. Merely another case of too much imagination among rumor retailers.

In our last issue we mentioned that Mr. James D. Begg had been appointed master mechanic of the Southern Pacific Railway at Houston, Tex. The correspondent who sent this information stretched a point, for Mr. Begg was only appointed machine shop foreman. We are entirely at the mercy of correspondents in cases of this kind, and they sometimes make mistakes.

Mr. E. M. Roberts, lately superintendent of motive power of the South Carolina & Georgia Railroad, has accepted the position of general manager of the Washington Carbon Co., Pittsburgh. Mr. Roberts was one of the ablest mechanical men in railroad business, and we regret to see him wander into a new field, but have no fear that his success in any line he engages in will be away up.

Mr. G. A. Haggerty, for the last eight or ten years master mechanic at McAdam Junction, an important point on the Canadian Pacific in New Brunswick, has resigned. Mr. Haggerty was intensely popular in New Brunswick, and was regarded as one of the most accomplished engineers in the province. He was a graduate of the Mason Locomotive Works, and held several important positions on railroads in the United States before going to Canada.

In an address on "Arbitration of Labor Disputes," delivered before an audience largely composed of railroad men, at the Union League Club, in Chicago, Mr. Carrol Wright made plain some principles of attitude between labor and capital which cannot be too well understood. The text of an excellent address was: You must not injure your neighbor's property, you must not injure your neighbor's health, and you must not interfere with your neighbor's way of making a living.

We are always glad to make a note of the fact when a man who began work in the lower ranks of railroad life rises into prominence. One of the latest notices of this kind which we are pleased to make, is the appointment of Mr. William B. Biddle to be freight traffic manager of the Atchison, Topeka & Santa Fé, with headquarters at Chicago. Sixteen years ago Mr. Biddle entered the service of the Santa Fé as a brakeman. It redounds to his credit and may have something to do with his success that he was one of the best brakemen that ever took possession of a fireman's seat.

Mr. George W. McGuire, the well-known representative of the National Malleable Castings Co., of Cleveland, has gone to Florida to spend the winter. His health is not entirely restored, but it improves steadily, and there are good prospects that he will soon be as well as he ever was, which will be good news to his numerous friends. We know of no one who has made such a brave fight with a terrible disease. There is no doubt that Mr. McGuire's steady courage, which led to no excitement in the presence of the worst symptoms, did much to lead him victorious over his sickness. In his fight he was aided by a most devoted wife.

Mr. Franklin Murphy, president of the Murphy Varnish Co., of Newark, N. J., and well known among railroad men who use good varnish, is spoken of as a highly available candidate for Senator from New Jersey. Mr. Murphy is come of highly patriotic stock, his grandfather having fought in the revolutionary war. Mr. Murphy himself joined the Union army as a private during the rebellion, when he was sixteen years old, and came out a lieutenant. Like many other soldiers, he devoted his abilities after the era of peace with so much energy to industrial pursuits that he achieved great business success. The road now appears open to him to high political honors.

Mr. Charles A. Sheldon has resigned as Assistant Division Superintendent of the Michigan Division of the Lake Shore & Michigan Southern R. R. to accept a position with the Consolidated Car Heating Company, Albany, N. Y. He will have charge of the Compressed Gas Lighting department of the Consolidated Company, which is about to introduce the Pope system, interchangeable with the "Pintsch," throughout the United States. Mr. Sheldon is a graduate of Yale, class of '90, and has been with the Lake Shore road since graduation, four years ago, having risen through several grades to the responsible position of assistant division superintendent. He has shown great ability in railroad matters and his many friends will be glad to learn of the important position which he now assumes with the Consolidated Car Heating Co.

Mr. Thomas P. Egan, president of the J. A. Fay & Egan Co., of Cincinnati, is taking a very warm interest in organizing the manufacturers of the United States to work for the renewal of the reciprocity treaties which were abrogated by the Wilson bill. He is in a business which profited materially by the reciprocity treaties, and is in a position to appreciate the industrial needs of this country. Mr. Egan has recently secured a controlling interest in the Cincinnati *Gazette*. His is a good illustration of what push and energy can do to raise a workman from the lowest to the highest rung of the ladder of life. He looks to be about forty-five years old. Twenty years ago he was working as a machinist. Now he is the head of one of the most important business houses in Cincinnati. We do not need to look for in this country for grand examples of self-made men.

TWO OF A KIND—W. W. SNOW AND AARON FRENCH, OLD-TIME SUPPLY MEN.

At the annual meeting of the New York Railroad Club, held in New York last month, the following officers were elected for the current year: President, George W. West, superintendent of motive power, New York, Ontario & Western; First Vice-President, A. E. Mitchell, superintendent of motive power and machinery, New York, Lake Erie & Western; Second Vice-President, W. H. Lewis, master mechanic, Delaware, Lackawanna & Western; Third Vice-President, H. H. Vreeland, president Metropolitan Railway Co.; Treasurer, C. A. Smith, superintendent Union Tank Line; Executive Committee—W. G. Wattson, superintendent West Shore; W. C. Ennis, master mechanic, New York, Susquehanna & Western; W. W. Snow, president Ramapo Iron Works; S. Higgins, superintendent motive power, Lehigh Valley; C. E. Fuller, Central Vermont. Finance Committee—F. M. Patrick, H. W. Johns Mfg. Co., R. M. Dixon, Safety Car Heating & Lighting Co.; D. M. Brady, Brady Metal Co.

EQUIPMENT NOTES.

The Brooklyn Bridge Co. are asking for bids on two bridge engines.

The special refrigerator cars of the Plant System have not yet been let.

It is rumored that the Southern Pacific are about to contract for 500 freight cars.

The Schenectady Locomotive Works have just closed with the Fitchburg for five switchers.

The Mt. Vernon Car Mfg. Co., of Mt. Vernon, Ill., have taken the Mexican Central order for 225 freight cars.

Harlan & Hollingsworth Co. have an order from the Savannah, Florida & Western for ten passenger coaches.

The South Carolina & Georgia Railway Co are in the market for 250 box cars. Bids are being asked for.

The New York & New England order for 1,000 cars has been partially placed; balance is likely to be let within a few weeks.

The rumor, so vigorously circulated, that the Lehigh Valley are about to let 1,400 additional cars is stoutly denied by officials of that road.

The New York, New Haven & Hartford have placed an order with the Rhode Island people for twenty-five locomotives. They have also given out an order for 100 cars.

The Mason Regulator Co., of Boston, Mass., report that their business for the last month was better than it has been for any month since the business depression began.

The balance of the 500 freight cars to be ordered by the Southern Railway Co. has not yet been placed. The Lenoir Car Co., of Lenoir City, Tenn., have the order for 250 cars.

The Rhode Island Locomotive Works have just shipped a locomotive of the Hudson type to Jamaica, West Indies. They formerly sent other engines of this type to Jamaica and they are reported to be in high favor.

The Consolidated Car Heating Company, Albany, N. Y., has just awarded the contract for an addition to its factory which will practically double its capacity. Its rapidly increasing business in electric heating appliances and the requirements of its compressed gas lighting business have necessitated increased facilities for manufacturing.

A Catechism of Car Painting, by Mr. Frederick S. Ball, master car painter, of the Pennsylvania Railroad, at Altoona, Pa., has been published by the *Railroad Car Journal*, New York. It is in neat pamphlet form and costs only ten cents. Everybody who wants to know something about car painting ought to send for this useful little book.

The Crosby Mfg. Co., Boston, find that the duplex check valve and stop-cock which they put upon the market lately is becoming highly popular. This is a very ingenious device, for it is so arranged that should a valve get out of order another valve inside the same shell can be instantly thrown into service. The valve can also be set to form a stop cock, which is a great convenience when repairs have to be done hurriedly.

Everybody knows something about "Magnolia" metal and the celebrity it has obtained as an anti-friction metal. An enterprising firm in New York, wanting to share the benefits that the Magnolia metal's fame gave forth, started selling a metal which they called "Mongolia" metal, the idea evidently being that the name was so near like Magnolia that the ordinary reader would not detect the difference. A suit was brought against the parties who attempted this shrewd piece of business, Benjamin and Moses Lowenstein, and Judge Lacombe, of the United States Circuit Court, has granted an injunction against them restraining them from selling the metal.

Practical Letters from Practical Men.

Facts Wanted. There's a glut of Opinions.

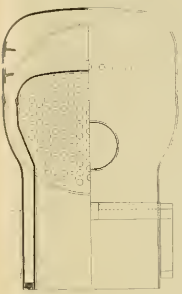
Write on one side of the paper, state your point plainly and briefly, and then quit. We supply the generalities. No letters noticed unless name and address are annexed.

Early Use of Curved Shell and Crown Sheets in Belpaire Boiler.

Editors:

In your October issue, in describing the Brooks engines recently built for Brazil, you refer to the boilers as being "what the Brooks people call the 'Improved Belpaire,' patented by their mechanical engineer."

You further state that the peculiarity of this patented boiler lies in the form of the crown sheet and the roof or shell sheet over it, or, to quote from your description, "the top of wagon top is arched, as is the crown



sheet, about 2 inches, and the crown stays go through the sheets radially." As a matter of record I inclose a blue print, showing the back end of the boiler of some engines built for the Denver & New Orleans, and the Boston, Hoosac Tunnel & Western Railroads, by the Rogers Locomotive and Machine Works in the year 1881. You will note that the crown sheet was curved to a radius of 8 feet 8 inches, and the roof sheet to a radius of 10 feet 3 inches, and that the crown stays passed through both sheets radially, just as you mention them to be in the "Improved Belpaire" referred to.

If the patent was granted on the claim of curved crown and roof sheets and radial stays, it would seem that the Rogers boilers embraced all of these features and anticipated by several years the "Improved Belpaire."

W. F. Dixon,
Chief Draftsman, Rogers Loco. Co.
Paterson, N. J.

Does Full Throttle and Close Cut-Off Have Anything to Do with Worn Ties?

Editors:

In your letter replying to mine inquiring cause of flat tires, you say that the hammer-blow crank was not such a crank after all, and that the hammer blow is something that must be dealt with in every case.

As I understand it, the hammer blow is the same, whether running with or without using steam.

The engines that give us the most trouble are well counterbalanced, and have no pound or jerk, except when working full throttle with the reverse lever hooked close to center. This knocking and jerking is relieved as soon as the lever is dropped a notch or two.

The flat places in the tires occur at the point where the jar or jerking takes place, which is just before the left piston reaches the front end of its stroke.

My conclusions are that the vertical influence or the centrifugal lift of the counterweight, coupled with the high initial pressure, is what causes the pound and the flat places.

I really want to know something about this matter, and would like to have it pointed out where I am wrong. If it's the hammer blow, why will dropping the reverse lever down relieve it?

Again, why is it that men who wire-draw their steam and work the reverse lever down where engine runs free, are able to run these engines two years without flattening tires, while the men who run the same engines with full throttle and close cut-off will flatten their tires in from eight to nine months?

I have long been an advocate of full throttle and close cut off, but can't help but note that the full throttle engineer's engine is always in the shop first.

D. O. Smith, M. M.,
M & O. R.R.
Whistler, Ala.

[This is a question which deserves to be thoroughly investigated. We should like very much to hear from others who have opportunities of noting the causes of wheel flattening. If there are other facts to substantiate the views of Mr. Smith let them be known.—Eds.]

First Invention of the Track Tank.

Editors:

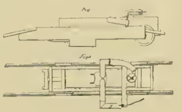
In your issue of November, 1894, page 357, you make a statement that the track tank was invented by Ramsbottom, Superintendent of Machinery of the London & Northwestern, in 1858.

The impression given by this article would imply that he was the first inventor of this very useful device, when, in fact, an American named A. W. McDonald, of New Creek Depot, Va., secured a patent in the United States for the same, four years prior, the date being Nov. 28, 1854.

Thinking that your readers would find this information of some interest, I herewith inclose a drawing and a brief description of the same.

Grenville Lewis,
Examiner U. S. Patent Office,
Washington, D. C.

[This is interesting information. We do not consider a description of the McDonald



device necessary. The engraving shows it plainly enough. The tank is the same as now used. The scoop was double, taking water to tender by two large round pipes and hose. Ramsbottom was the first to put a track tank into practical use, and has always received the credit for its invention. McDonald, doubtless, was a prior inventor, but not a user.]

Duplex vs. Single Gauges on Instruction Plants.

Editors:

In perusing Mr. Synnestvedt's article in the November issue of Locomotive Engineering, I am pleased to note his complimentary remarks on our "Ignorance Exterminator," as our air-brake schooling plant at Green Island has been termed, but in the interest of others who contemplate equipping their shops with such a plant, and who may possibly be misled if his erroneous assertions are not refuted, I cannot pass his suggestion to use single-pointer gauges instead of double ones, especially when the latter are available.

I consider the statement a remarkable one to come from an instructor, for I do not believe the auxiliary reservoir pressure and that of the brake cylinder can be better shown than upon a duplex gauge, where the relationship of the two is graphically shown by the rise and fall of the red and black pointers and their ultimate equalization, or in a manner by which it can be more easily comprehended by the pupil.

The ground he takes that a man is liable to become confused in trying to watch the two hands of the duplex gauge, as he is obliged to do when the red one, say, marks the auxiliary reservoir pressure and the black registers the brake cylinder pressure, is very weak. His idea of placing gauges is frequently impracticable, even if it were desirable; and a man who must have a gauge screwed directly into the part whose pressure it is to register, or must have different gauges to mark each pressure to avoid becoming confused, is indeed dull of comprehension, and would, in the same line of reasoning, demand, and be entitled to, two single-pointer gauges instead of the one duplex gauge given him on his engine, that he might avoid becoming bewildered in operating his brakes.

When Mr. Rogers, my predecessor, installed the plant at Green Island, single-pointer gauges were used as they were the only ones available at that time. Later on, when a sister plant to this one was placed at Whitehall, another division terminal of the D. & H. C. Co., duplex gauges were available and were accordingly used, as it was believed that pupils would more easily comprehend their meaning when so employed. Experience has confirmed this belief.

Having a plant at each terminal of this division almost precisely like each other in equipment, except in the one feature of gauges, I find much more satisfaction is derived by the men, as well as myself, from the Whitehall plant, where duplex gauges are used, than at Green Island where single gauges are now employed, but which will be replaced by others of duplex pattern soon, for experience has taught me that the latter kind is greatly preferable in every way, and I would advise their use by others who desire to have a serviceable and comprehensive air-brake schooling plant.

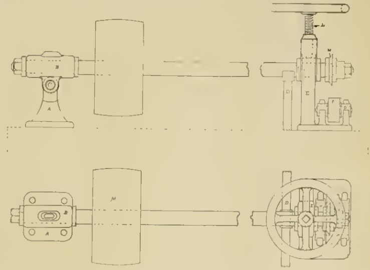
R. C. Cory.
Green Island, N. Y.

Machine for Cutting Off and Scarfing Flues.

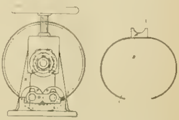
Editors:

When flues are cut out of a boiler undergoing repairs, the first thing done with them is to clean the scale and dirt off, then the rough, split ends must be cut off preparatory to welding on new ends. This operation is with some a slow and tedious one, being in many cases obliged to take them to the machine shop, where some old lathe is utilized for a cutting-off machine. While this method is an improvement over hand cutting, I have found the machine illustrated to be far superior. It is quicker and cheaper; no chucking, no stopping of the machine.

By referring to the drawing it will be seen the tube is laid on the rollers *F* and the cutter *H* is forced on the flue by the screw *L*. The outer bearing is pivoted on its support *A* to allow a vertical movement of the shaft at the end carrying the cutter. The spring *D*, 1x1/16 inch, surmounted by



the half box *N*, carries the weight of the shaft as shown. The spring is attached to the timber forming the bed of the machine. After the rough ends are cut off it will be found necessary to scarf the end for welding. This can be done with the same machine, by taking off the cutter *H* and replacing it with a shell reamer tapered to suit the scarf or bevel required. By arranging a wooden lever hinged at one end the tube can be forced on the reamer and scarfed in a very short time. To prevent the tube from turning, a simple clamp can



be secured close to the end being scarfed. The supports of the machine *A* and *E* should be at least 5 feet apart.

F. M. Arthur.
Reading, Pa.

The Last of an Old Question.

Editors:

Referring to the September number of your paper, in the criticism on my article in the August issue, I wish to state that the gauge hands did not fall after the heavy oil mentioned was used until so much time had elapsed that men who were not posted on air, and who were in the habit of riding over on the emergency notch, would see no difference in the black hand, and were misled in their efforts precisely on that account, when, if the black hand had fallen as on the brake valves of later date, it would have been observed, and much light thrown on a subject then not very well understood. When giving instructions some three or more years ago, in order to emphasize this point, I was in the habit of putting brake handle on lap, exhausting train pipe, and, while striking or jarring the gauge pipe, show that the black band remained practically stationary. I finally found a valve that would not hold, and believing the rotary valve to be the cause, changed the brake valve, and put on one that held the black hand at 70 pounds, having scraped the valve, but it was found still leaking, and then the repairman located the trouble. He found the piston 17, Plate D 8, 1/4th less in size than the cylinder, so he with a soldering iron tinned the outside of piston and turned it to fit. When the valve was placed on an engine the black hand showed all right, but here is where the trouble came in, and I suppose others have been there, too

The main reservoir was under the foot board and fastened to frame, the brake valves were fastened to brace on boiler head, and there was a constant springing of the bottom cap No. 5 because of expansion, and sometimes when the brakes were applied the piston would stick up, and I soon came to the conclusion that friend Synnestvedt did, namely, that it [illegible] *not* necessary.

As to the correct reading of engraving shown on page 241, July number, I have taken this matter up with a number of draughtsmen, pattern shop foremen, master mechanics and others used to reading drawings and the opinion is unanimous that but three pulling points are shown on lever referred to, one at either end and one in the center. On explaining the exception taken to this reading all parties agreed that the lever was not shown passing through the slot, nor was there any pin or fulcrum shown in the sketch at the point mentioned, and unless they had some other source from which to get an idea of the workings of this brake, they would be forced to reject the plan on account of the unequal leverage. As to the last point taken up, the object in calculating the leverage, was merely to induce those who have no drawing or models accessible to see where in they could in a measure obtain the information needed—in other words, to perhaps show someone who wants to know that there are methods of gaining points within the reach of all, but of which advantage is [illegible] times not taken, because they do not follow the old road.

GEO. F. HOLMES.

Roanoke, Va.

Handy Jobbing Chucks.

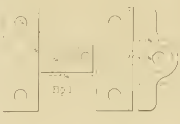
Editors

In the repairs of locomotives it is safe to prepare for any job and get chucks or other devices for the same, as the number of times that the job will come will only be limited by the number of engines that pass through the shop and occasionally some from the roundhouse. When they come from the latter place, they are almost always in a hurry, and then is when you want to have something to handle them quickly, and not have to hunt up bolts, straps, clamps, and a half dozen other things that someone else is using just then, and which will cause you to have some new ones made. It is then that a special chuck will be appreciated. Did you ever notice that the job that is worst to hold, or for which you are getting some device to hold securely, seems to come the most often until you are prepared for it? After that you never seem to know when it comes.

There is one job in the shop that will always have a lot of planing and slotting done by hand in the vise, and that is making tools. The reason, I suppose, is that they are not made very often, and when you start in to make a tool it is most likely wanted as soon as possible, and you do not have time to rig up anything to help do the work better and quicker. After the tool is made, you do not have to make another for a year or two, and do not need the tool-making appliances; that is, if it does not break, for it is well known that a tool in a locomotive shop very seldom wears out—I was going to say never.

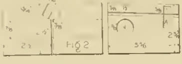
The two chucks here shown are for doing just such jobs. They are easy to make, save lots of time, and do the jobs better. One is for holding the case of a tube roller while the slots are being cut, and the other to hold sections of expanders while planing the taper.

For the castings in Fig. 1, anything that one has convenient will do, and drill holes to bolt on slotter. Then bore a 7/8-inch hole through and counter-bore 1/16-inch deep, one the size of shank end of roller case, the other the size of end that goes in tube. Bore for largest size, and for smaller ones make bushings to fit *G*, and a 5/8-inch or 1/2-inch bolt to bolt all together. After the case has been turned and laid out, all of which should be done in lathe, except



the three holes, *A*, Fig. 1, lay these out the size of slot and drill. Use chuck for holding and you will be ready to slot the balance.

Get a piece of steel the size used in the slotter, and make tool with square face 1/16-inch and round back, as heavy as will go through hole and not more than 1 inch long, so there will be no spring. Set on slotter table so that the hole will be one side of center, to give the clearance to the roller, and when one side is done loosen the half-inch bolt and turn work to the other side of center. Tighten up again,



and finish that side. Repeat on each slot and you finish the case without vise work.

This is for a case where the case holds in the rollers. We use a case where the rollers are held in with a spring. In this case the slots are square through 1/8 inch longer than roller.

In making expanders, we have the forgings 8 inches long. Center each end for planing, plane the exact angle for three rings, with the same number of set-screws as there are sections. Put one on each end and one in the middle, with 1/2-inch mandrel through center. After they are turned and taken apart and the end broken off, as it will be found best not to cut them clear off, they are finished, except the taper. As there is nothing straight about them, they are hard to handle, as you are sure to spoil the edges. By following this plan you get two expanders with very little more labor than is needed to make one.

Fig. 2 shows what I rig up—two blocks of iron 2 1/4 inches square, 3 3/4 inches long. Plane on all sides, then lay into the groove and plane when you drill well through to tighten together. Have in a piece of square iron so as to hold it in line. Then put in bolt that just fills hole. Now plane off bottom of blocks to taper that you want section of expander, drill the hole and put in a 1/4 inch pin to serve as a stop, *A*, Fig. 2. We are now ready to do the work. Bolt one block to table of shaper, the other is held with the bolt that clamps the two together. The bolt should be loose in hole. Put in one section and tighten up. Set drill so as to leave a finishing cut. Change sections instead of cut. It is best to do this, and they will all be the same size when finished. By doing this work in this way, you will have done another job without the aid of a vise.

W. A. ROBERTSON.

Cedar Rapids, Ia

The First Gun for Shooting Out Bolts.

Editors

In the columns of your paper I note an article on a cannon for shooting out tight frame bolts, which is credited to the Erie shops. The true history of this invention, at least so far as I know, is this. It had been used for some years in France, and in the winter of 1891 I was going over the Erie Railroad with one of the Leslie snow plows. The chief draughtsman for the Leslie Company, Mr. Metzger, was in the caboose with me, and we were talking over various shop practices and handy tools, and he described the gun which you illustrate. Shortly after coming to the Roanoke Machine Works as general foreman in February, 1893, my attention was called to the large number of bolts which had to be drilled out of frames and cylinders, and very naturally the suggestion of my friend in the caboose came to mind, and we built what, so far as I know, was the first gun of this kind built in the country. Last summer, while visiting the Susquehanna shops of the Erie Railroad, I described the gun to Master Mechanic Bond. In fairness to Messrs. Mitchell and Bond, both of these gentlemen have recently informed me that they gave due credit to the Roanoke Machine Works for the suggestion. I think, however, the credit belongs to my friend, Mr. Metzger.

We heartily endorse all you say in regard to the great advantages of the gun, and will say that it is in general use along the line of the Norfolk & Western Railroad.

H. A. GILLIS.

Roanoke, Va.

There was very little done in America towards railroad building of any kind until about 1830, and there is an impression among our people that the Liverpool & Manchester Railway, which was opened in 1829, was the first railroad put in operation in Europe. This is a mistake. There were a great many railways in use before that time, most of them operated by horses. In 1811 there were reported to be 180 miles of railway in operation in South Wales alone. In 1813 a book on railroads by Von Gerstner, was published in Germany, and it contained particulars about a great many railroads that were in operation on the Continent.

How Rail Joints May Be Well Made.

BY JOSEPH ANTHONY.

In preventing an ill, or in attempting to cure one, the best results obtain when the ill's origin is understood. The origin of weak and low joints arises from want of the rail's continuity—however long they may be they cannot be endless. While

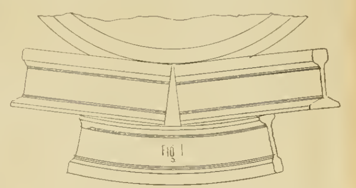


Fig 1

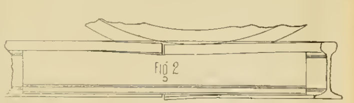


Fig 2

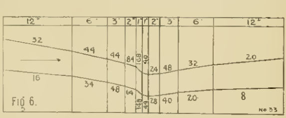


Fig 6.

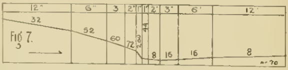


Fig 7.

the coming 60-foot and mitre-ended rails will lessen the number of joints, they will not perfect those that remain. The study of joints is therefore yet important.

As is apparent to an interested observer all ballast in which the sleepers are bedded is to some extent compressed by the weight of passing trains, and the rails over them partake of a like vertical movement. The sleepers, while thus sinking in detail, yet leave most of the rail's surface practically in the desired plane. It may be a depressed plane, but as the valley that the weighted wheel makes, and in which it runs, ever accompanies it, the plane is therefore, to the wheel's path, yet intact.

While this is true along the middle portions of the rail's length, it is not true at its ends; at these points the action is intensified and here the fault is developed. By its own stiffness the rail, along its middle portions, distributes the load it bears over several sleepers at one and the same time. This it cannot do at its ends, for here its continuity, its stiffness, practically ends. The result is that that which was a valley-like depression of the rail's surface elsewhere, at the joint becomes an angular depression through which no wheel can pass save as it administers a shivering blow on the upward angle that the first end of the rail forms one side of, and each such blow prepares the way for a worse one to follow. With a yielding substructure this result is apparently unavoidable. No joint splice *per se* can be made strong enough to avoid it. Fig 1 makes this point clear.

Here is represented a low joint, exaggerated in order to make its working plain, which is spliced by an inverted piece of rail of the same strength as that of the track itself. The kind of fastenings are immaterial and none are shown. In all cases of subsidence at joints, as they are now laid, it is plain that the best splice that is made will fail to bend the rail above it to the curve that it itself may be brought to assume. If a splice of this kind should even be solidly welded in place, the increased stiffness of the combined parts, each way from the rail's end, would yet cause the injurious angle, instead of an innocent curve, for the wheels to pass over. Now if instead of a splice having a degree of integrity like the one just shown dependence is placed on the ordinary angle bar, which is authoritatively stated to have only 30 per cent. of vertical strength of the rails to which it is attached, and which, furthermore begins, as soon as used, rapidly to deteriorate, what wonder that the joint problem is deemed to be difficult of solution ?

Without taking into account the angle formed by the rails at a sunken joint, Fig. 2 shows the relation of the parts thereat when spliced by the ordinary angle bar.

The small area of bearing surface under the heads of the rails, and that too, mainly at their extreme ends, admits of a quick abrasion and a narrowing of the bar at its middle and vital point The consequence is that, as the cut shows, there is ever a changed vertical relation of the rail's ends as a wheel passes from one to the other, which is unmechanical in an extreme degree No master mechanic, if he had charge of the track's mechanism, would for an hour tolerate such an absurdity.

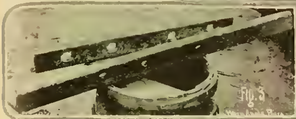
Fig. 3 is from a photo, showing the worn and thus faulty edge of an angle bar.

Figs. 4 and 5, also from photos, show the features of sunken joints and the battering by the wheels due to the angle formed thereat. Both are taken from the plant of the C & N. W Ry., and are thus examples of what passes for good engineering

Figs. 6 and 7 show in detail the grades in feet per mile of joints in the tracks of the same road. They show a length of two feet each way from the rail's end, and are representative of the average joint, after a few years' use, in all double track roads.

These diagrams of the ill under consideration show it to be due primarily to such a settling of the sleepers, or the ends of them, as to cause angles to be formed at the rail's ends, and its prevention, therefore, involves a more complete integrity of the rail's support from beneath. This means that where the vertical strength of the rail is least, where its continuity ends, there the area of bearing on the ballast should be increased, and increased exactly in proportion as the continuity of the rails is broken. Here has been our complete mistake. We have attempted to reinforce the rails at their ends instead of the foundations on which the ends rest. To be preventive of the ill, let such an area of bearing on the ballast be furnished as is due to the load it has to sustain, as modified by the rail's stiffness under all its length, and the splicing is effectively done

Let the supports on each side of a joint be in practice what in theory they are supposed to be—as the piers of a bridge—and there are a number of splices that are amply stiff to carry the load from one of them to the other; but let there be a pumping or vertical movement of these members as the wheels go over them, and the joint question will remain, as it ever has been, the prime cause of tracks that are costly to maintain and uneven and dusty to ride over.



If the angle bar splice is to be retained it should be made narrow enough to admit of a liner or liners to compensate for wear where needed between its upper edge and under the rail's head If this liner remedy for wear is deemed or proves insufficient, there is the Churchill (N. & W. Ry) bottom-bearing splice which, in principle, leaves nothing further to be sought. I emphasize the fact and urge all who would have the track as perfect as is the machinery it carries to beware of any kind of a rail splice alone, as a sufficient joint support. To accomplish this last, the anxious and studious roadmaster must go deeper, must use a form of support and a method of vertical and lateral rail adjustment that will be preventive of harm rather than be remedial after the harm has resulted.

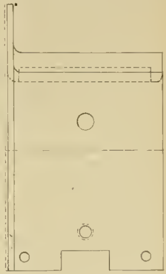
Fig. 8, from a photo, shows perspectively such a form and arrangement of parts, in principle, as admits of furnishing a bearing on the ballast which may be proportioned to the rail's want of continuity and the effects of the passing load.

These bearings should be individual ones in order to avoid pumping the ballast from beneath them, neither should the rails be fastened to their supports. The rails' vertical movements, if any, *must not* affect the members on which they rest, they therefore must be tied and anchored substantially as shown. As tamping for vertical adjustment is thus happily gotten rid of, some of the many known means of exactly and surely accomplishing the same end, and which may be applied above the supports and below the rail's foot, should be used A last and further perfecting feature of a joint is to have the rail's ends, for a foot or two in length, bent upward, the joint raised, just to the extent that under passing trains the slight though probable and useful elasticity and consequent depression will cause the wheels to ever find for their path, in all portions of the track alike, a sure and a desirable plane.

Weak Cast-Iron Driving Boxes.

One of the weakest parts about the ordinary locomotive is the cast-iron driving box. Steel and strong alloys, such as bronze and Ajax metal, are slowly but surely crowding out the cast-iron box, but it will be many years before it entirely disappears.

Mr. John Mackenzie, of the Nickel Plate, who is a man noted for accepting the lessons of experience, said on this subject: "I have had the same experience with cast-iron boxes that I find my neighbors have—broken flanges and broken boxes About two years ago we took up the steel driving box with a square brass. The trouble with the cast-iron box with the circular brass, or the gib brass, has been that the brasses would get loose The first idea we had was to get something that would stop that. We made a steel box and made the brass fit square. By reason of the box being steel and getting strength enough there, we thought we could work them in. The brass is fitted into the box square, and goes clear down the whole length of the box. The cellar is fitted in between the brass and the oil cup, so that we have a perfect contact of brass and metal, easily fitted The brass is made square, as I said before, with a flange cast on the outer edge of it, which is the hub protector. Or, in other words, we run the brass against the hub instead of the steel. Now, so far as those boxes are concerned, in running, we have an engine in the shop now that has made nearly 115,000 miles in fifteen months. The boxes were worn a little loose on the journal, but all that was necessary in that case was to recrown the brass and let it down. The boxes were absolutely as tight as they were the day they were put in—the brasses—but we found a terrific wear on the wedges. The cast-iron wedge and the steel box will not wear That is the only trouble we find with those boxes Now we are planing those boxes out and putting a bronze gib on the face of the box where it wears, and using wrought-iron wedges. We propose to case-harden those wedges, and we think we will have a driving box that will not give out for a good many years."



MACKENZIE'S DRIVING BOX.

At the late election in the city of New York a vote was carried by a large majority in favor of the municipality building a system of rapid transit railways. The inadequate service and accommodation provided by the Manhattan Elevated Railroad Company did much to bring about the people taking rapid transit into their own hands.

The announcement is made that the Pennsylvania Railroad have decided to increase the standard weight of rail from 85 to 100 pounds. All renewals on the main line between New York and Pittsburgh will be made with steel of that weight.

Nickel Plate Notes.

The problem on the N. Y., C. & St. L. Ry. (Nickel Plate road) when our genial friend, Mr. Mackenzie, took hold, was a very difficult and trying one. As originally constructed, the road was built to sell, and no particular requirements or conditions placed upon those furnishing the power, other than so many freight and so many passenger locomotives; and, as would naturally be expected, a great many over-

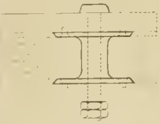


Fig. 1.

loadered and weak-kneed engines were furnished. Mr Mackenzie had a very trying and wearing problem to get results, bring up the power to a maximum degree of efficiency, and keep down the expenses of the motive power department, but the magnitude of the problem did not disconcert him. He has gone steadily on, strengthening weak parts, and when replacements have been made they have been done on "up to date" methods.

The general policy of reconstruction has gone steadily on, the boilers of the 18-inch freight engines replacing worn out boilers on the 17-inch passenger engines, and new modern boilers furnished the larger freight engines. It goes without saying that the new power ordered from time to time is of the best and most approved design, so that all the power now looks well, does good work, and compares favorably with other representative roads. The writer spent the day in the shops of the company, and from his knowledge of former days could appreciate the march of improvement along the line.

At the Conneaut shops, we noticed a novel and excellent way of prolonging the life of cast iron or steel crossheads. Ordinarily, when the pin is reduced in diameter below the safe limit, or worn out of round, the whole crosshead is scrapped. The Nickel Plate people, however, cut out the old pin and make a dove-tailed slot on either side, and fit in a forged pin in accordance with shaded portion of Fig. 1. This method has given great satisfaction and even better results than with the original pin.

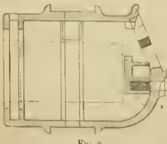


Fig. 2.

A novel form of end stop for tender axles is used (see Fig 2)—the large tender axles with collarless journals, after making the required mileage, are turned down to journals with collar, and used under 40,000-pound cars. This form of end stop provides for the insertion of liners between the stop and box to take up any excessive lateral wear.

The economies in the use of oil instituted have produced satisfactory results. The record of oil used on guides has increased from 44 to 90 miles per quart, and valve oil from 60 to 105 miles per quart. One engineer has made a record of 400 miles per quart of valve oil by arranging his feed to drop two drops uniformly per minute.

The provision for oiling wedges and hubs between driving boxes is provided for by an oiling cavity in the box, so no oil is used en route by the engineer.

Making the Most of Scrap.

During a brief visit to the repair shops of the Chicago, Milwaukee & St. Paul, at West Milwaukee, we found a notable improvement in the storing of scrap which is well worthy of imitation. The condition of the average scrap heap is too well known to call for long descriptions. Every article of iron, steel, and sometimes brass used in railroads, from the fish plate to the rim of the smokestack is thrown together in a confused heap. The theory is that useful articles in the scrap will be utilized in repairs, but when a particular article is wanted, it is so hard to find that after wasting more time looking for it than the stock is worth, the smith or machinist goes and gets an order for new material. And so the scrap heap is constantly augmenting, and none of it is used except what goes for reworking at the few places where they have scrap furnaces.

Scrap City at Milwaukee.

At the Chicago, Milwaukee & St. Paul shops they have introduced a systematic method of arranging scrap, so that a large proportion of it will be used without having to go through the furnace.

The preliminary process of selection is the arranging scrap of a similar character together. A large space in the yard has been laid off in streets and alleys, with scrap bins for the houses. The streets are so arranged that cars containing the scrap to be deposited in the bins can be brought alongside, while easy access is provided for trucks to carry the assorted scrap to the shop where it can be used

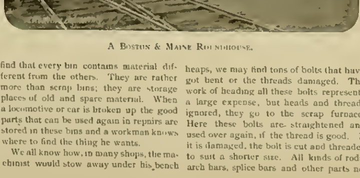
As we pass through the streets and alleys accompanied by Mr. A. E. Manchester, we find that every bin contains material different from the others. They are rather more than scrap bins; they are storage places of old and spare material. When a locomotive or car is broken up the good parts that can be used again in repairs are stored in these bins and a workman knows where to find the thing he wants.

We all know how, in many shops, the machinist would stow away under his bench bolts, oil box cellars, rockers, piston rings, follower plates, slide valves, hangers and various other parts that were considered too good to throw away. They would come handy when an engine came in needing one of these parts. But very rarely did they come in. The accumulation went on till a cleaning up was ordered and then the whole lot went to the scrap heap.

In the Milwaukee scrap city, these parts and many others are placed in their own bins, and a machinist or car repairer knows that he can have a good selection in choosing an article that he wants. The practice followed is to repair defective articles and put them, if possible, into standard forms.

Streets and Alleys in Scrap City.

The saving effected by the plan is readily appreciated in the case of bolts. In ordinary circumstances, in big scrap heaps, we may find tons of bolts that have got bent or the threads damaged. The work of heading all these bolts represents a large expense, but heads and threads ignored, they go to the scrap furnace. Here these bolts are straightened and used over again, if the thread is good. If it is damaged, the bolt is cut and threaded to suit a shorter size. All kinds of rods, arch bars, splice bars and other parts not suitable for re-using in its own line is converted into something else under the bulldozer or steam hammer. The policy is to avoid using new material as long as scrap can be utilized without too much work. Mr. J. N. Barr has taken a very practical interest in this method of cutting down expenses, and he is to be congratulated upon the results.



A Boston & Maine Roundhouse.

Material for Driving Boxes.

At the last meeting of the Central Railroad Club a report, prepared by Mr. Geo. W. West and Mr. S. Higgins, was presented on "The best construction and practice in locomotive driving boxes, including a consideration of the comparative merits of solid bronze boxes compared with cast iron or cast steel with bronze lining." A decided stand was taken against the use of bronze driving boxes, for the reasons that the first cost was greater, and that the great expansion of the metal when heated causes it to stick readily in the jaws of the frame. Besides these objections, it was stated that when the crown gets worn there is apt to be a pinching of the journal which results in a hot box.

One member had got good results from cast-steel boxes having brass bearing gibs with soft metal between them. The soft metal strips were made sufficiently long to bear against the driving wheel hub, thereby preventing the cutting that usually ensues when the hub rubs against a cast steel box.

The favorite kind of driving box was reported to be cast iron with bronze bearing gibs having soft metal filling.

Attention was directed to the practice now adopted by many roads of placing the driving box flanges straight at the center for a distance of 2½ inches, tapering them from there to the top and bottom. This permits the box to adjust itself when the wheel strikes a low joint and is a valuable means of preventing broken boxes.

In the discussion that followed the paper some of the members favored the use of solid bronze driving boxes.

The practice of cleaning the cushions of passenger cars with compressed air is rapidly spreading, and at some places it is customary to take the cushions to the platform and clean them when the car is not held long enough to go into the yard. Several roads tried cleaning the whole inside work of passenger cars by jets of air, but the practice is falling out of favor. Mr. A. M. Waitt, of the Lake Shore, speaking of this practice, said that it raised more dust than they got rid of, and Mr. Mackenzie, of the Nickel Plate, said it acted like a sand blast on the varnish of the window sills.

The Westinghouse Electric Company, of Pittsburgh, have built immense works on the main line of the Pennsylvania Railroad, about fifteen miles south of Pittsburgh. They are now putting in the machinery, which will be the most complete of its kind to be found in any shop in the country.

Dangerous Boilers.

The Hartford Steam Boiler Inspection and Insurance Company publish monthly a journal called *The Locomotive*, devoted to matters connected with steam boilers. A valuable feature of the paper is a part devoted to the record of boiler explosions. This record makes lamentably sad reading to those who have any feelings of humanity, and illustrates the recklessness for human life and suffering that our loose system of placing responsibility produces. In the month of August there were thirteen explosions of threshing-machine boilers reported, nearly every one of them causing death and suffering. A threshing-machine boiler is the most dangerous of any kind of steam generator, because it is generally in the care of incompetent engineers and because that class of boiler is not subject to proper inspection. The ignorant politicians who are sent to State Legislatures to make laws for the commonweal are to a great extent responsible for the death and suffering caused every year by this character of boiler explosions. They have the same ideas about boilers that existed fifty years ago when they used to put a freight car between the locomotive and passenger cars to take the shock of the explosion that might be expected at any moment and could not be provided against. They think that a boiler explodes just as a dog takes the rabies, and that it is as futile to try to prevent the one as the other. The fact that nearly all other steam boilers carry higher pressure than the boilers of threshing engines, yet threshing-engine boilers exploding much more frequently than all others combined, conveys no lesson to them. There would be no difficulty in arranging a boiler inspection law which would make threshing-engine boilers as little murderous as others, but there are always some cranks in State Legislatures that oppose the passage of laws of this character. It is high time that the good sense of the people was asserting itself to show that their sense of humanity is higher than that of the politicians.

Brake Leverage of Freight Cars

Mr Pulaski Leeds, of the Louisville & Nashville, who is noted for the practical character of his ideas about railroad machinery, made some suggestions last year to the Master Car Builders' Committee on Brakes and Brake Rigging, which deserved more attention than they obtained. The suggestions made induced us to devote particular attention to the subject, and from what we have seen of brake rigging within the last six months, we are inclined to believe that Mr. Leeds has indicated the proper remedy for a serious defect

He holds that with the present method of connecting the air brake the efficiency of the hand brake is destroyed. As we will likely have to wait a long time before hand brakes are entirely dispensed with, anything that tends to impair their efficiency is worthy of serious consideration. He considers further that the practices which reduce the efficiency of the hand brake, destroy to a great extent the efficiency of the air brake.

The source of this trouble is the arrangement of leverages. Originally the power of brake levers was multiplied five to one, and as an increase of power was obtained by using an 8-inch cylinder, an attempt was made to diminish the transmitted power that has produced awkward complications. While the brake leverage is fairly adapted for a car 40,000 and upwards, it is entirely unsuitable for cars that weigh 30,000 and under. With cars of light weight, the cylinder lever has to be so long that the connection between the top of the brake lever and cylinder lever has either to be on an awkward angle, or else the short end of the cylinder lever has to be so short that with a 12-inch travel it is thrown into opposite extremes of angularity, making the end that is connected to brake lever travel in a circle of about 7 or 8 inches radius, and distorting the apparatus to such an extent that there is not a straight pull in the entire equipment. To apply brakes to flat cars with fairly sensible movement of levers, they would need to be long enough to reach clear across the car, or else make the short end of the lever so small that it is impracticable to get 12-inch piston travel.

The highly practical remedy proposed by Mr. Leeds was that gondolas and other light cars weighing say from 17,000 to 22,000 pounds should have 6-inch cylinders and 12-inch stroke, cars weighing from 22,000 to 28,000 pounds should have a 7-inch cylinder and 12-inch stroke, cars from 28,000 to 36,000 pounds in weight, an 8-inch cylinder, and for large, heavy cars above 36,000 pounds weight, a 10-inch cylinder and 12-inch stroke. With this cylinder arrangement a truck lever four to one could be adopted, and the same lever for all car bodies. By doing this there would be no probability of an intelligent car inspector applying long leverages to cars, and as they would never have to change the cylinders, the probability of variation and application of wrong dimensions would be very remote with intelligent men.

Impairing the efficiency of the hand brake, as the existing arrangement of air brake leverages does, is a very serious matter. Although the leverage for the hand brake is made greater than for the air cylinder, it is not nearly enough, for it is difficult using with the hand brake more than half the power that the air cylinder transmits to the brake shoes. This could be remedied in several ways and it appears to be a plain duty of the Master Car Builders' Association to have the improvement carried out.

Converting Iron Scrap into Axles.

The season of using up the scrap heap to produce new stock is not entirely over yet, although many scrap heaps that used to be large are now very small. Those who are trying to make new garments out of old material may be interested in a description which Mr. William Smith, of the Chicago & Northwestern, gives of his method of making axles and crank pins from scrap iron. He writes

"I will commence with our car axles. We generally use the best of our own scrap iron and pile it in piles about 18 inches long and 10 inches wide and about 6 inches high. We put ten of these piles into the furnace at once and take a heat up on them. We then commence pulling them out of the furnace and hammer them on the top and sides until we get them partially solid, after which we hammer them into slabs about an inch or an inch and a half thick and about 6 inches wide. After we have handled them in this manner, we cut them across the middle and throw them to one side until cold. We follow this method of scrapping for a day or two. We then put these slabs back into the fire and reheat them, and draw them out in a slab, as already described. This we use for car and tender axles.

"What we use for crank pins and driving axles is what the blacksmith calls the 'knobs' off the car and tender axles, for, as you know, there are six or seven inches cut off each end of the axle. We throw as many of these knobs into the furnace as it will hold and bring up a heat. We then take them out, and place one on the anvil and flatten it out, and then place another on top of that, and sometimes a third one, until we get a slab about the proper size. We then hammer in the usual way. You will remember that this iron has already been reheated, but we pay no attention to that and lay it to one side, and when we get enough of these slabs we reheat them again and draw them out to the proper size. You will see by this process the iron has been twice reheated, once when made into a car axle and again when made into driving axle or crank pin. The slabs are generally cold when we reheat them. Whether this is any benefit or not, I cannot say, but they are more convenient to handle in that condition. All our crank pins and driving axles are made from this material.

"At one time I tried to make new car axles out of old ones by simply cutting off the journals, flattening out the axle, cutting them in two and forming them into slabs, and letting them go at that, and I thought I would have a very good axle; but when they were put into the drop test I found they were all crystallized and would not stand the test, and I finally came to the conclusion that we would reheat all the old axles the same as scrap, and have made a practice of that when using old car axles. The way I do with these old car axles is this I take one thick reheated slab, about 2 inches thick, which I put in the middle, placing a slab that has only been worked once on each side of it, and put them in the furnace in this way and get excellent results.

"The way I account for this is as follows Of course, the mass of iron is soft when it comes out of the furnace and goes under the hammer, and the hammer and anvil are cold and hard, and work the two outside slabs down in good shape, the center one, being a reheated slab, is affected only by the two outer slabs, and the reheated slab is in good condition before it is placed in the furnace at all, or, in other words, you have a good axle because the center has been well worked up before being placed there, and the outside is worked up from the hammer and anvil, and, to my mind, you have almost as good an axle as if you had used three reheated slabs. This saves the reheating of the two outside slabs and makes the axle a little cheaper."

Favors Soft Journal Bearings.

Some interesting facts were given by Mr. T A. Bissell, general manager of the Wagner Car Works, during a discussion on journal bearings. He said "We find in running cars over different roads that they will heat on one and not on another, when built up exactly the same Now, would it not be well to specify the lubricant? There is altogether too much difference in the oil that is used in different parts. Then there is one more point I would like to make We run cars on some lines and never have a complaint. We never have a chance to run cars about the yard to break them in. We send them from the shops on the fastest trains, including the Empire State, and have no trouble whatever. I do not remember of a single instance in which cars sent right from the shop on the fastest trains have not run cool. There may have been something of that kind, but not reported. Our boxes are made so that they can rest the entire length of the journal, and there is no rocking motion in any part, and there is no swinging motion of the equalizer. If made rightly in the first place, and fitted properly, they do not heat. In the first place, we make all of our boxes so that they will fit, inside and outside, they all go through steel templets, and the bearings the same, and the wedges the same, and when they are put on the journal they rest the whole length of it. We also take great pains in trimming the equalizer that is put on the plate on the bearing, and when placed under the car they do not tip one way or the other, but there is equal pressure on the different ends of the brass; and we find that with the use of the proper lubricant we do not have any trouble. The Pullman trucks are built in the same way. I have run brasses down to ⅛-inch in thickness and still they ran cool. I have run the lead lining alone 60,000 miles without wearing it out. When with the same device one man gets one result and another gets other results, there must be something back of that. It is either in the castings not being perfectly true and the existence of an unequal bearing—they do not use the proper method of getting them true—or else they do not have the right lubricant. We do not seem to understand the problem unless we go clear back and get the whole facts in the case."

The lead lining starts the journal running cool. If that is not properly lubricated on the start it will rub entirely off, a thing that sometimes happens when cars are moved about the shops

An experiment made some years ago was mentioned by Mr. J. D. McIlwain, where they had run a car with some of the bearings lead lined and others with plain brass. They found no difference in the wear of journals. He favored the use of lead-lined bearings because when equipped with them a car could be put at once on a train and would run without danger of hot boxes When plain brasses were used they had to move cars about yards for two or three days before they could be safely put upon trains.

We occasionally receive complaints from railroad officials because we did not make personal mention of changes or promotions of which they were the party of the first part. The trouble is that we are not gifted with omnipotent vision, and cannot tell when promotions and other changes take place unless our friends send us word. If they will do this we guarantee the personal notice. We have several times lately suffered in another way from want of omnipotence when zealous friends sent us notices of promotions that had not materialized. We are always willing to wait till a promotion takes place before we announce it. Do not send us word that a change has happened when it is only expected A great many changes that railroad men feel sure are coming never happen

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In the book published by the Pennsylvania Railroad, showing the company's World's Fair exhibit, there is an engraving of a primitive truck which was used under a boat car in the infancy of railways. The truck is called "primitive," but we are inclined to think it was built on sounder mechanical principles than the ordinary freight truck of to-day. It has a frame put very strongly together, with jaws for the axle boxes and half elliptic springs set over the frame of the truck, with stem resting on the axle box. A truck of this kind would be very easy on the track, and we consider it a pity that it was not made the model for the development of trucks suitable for modern cars

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The officers responsible for the obnoxious condition of water-closets and urinals of day cars on the average railroad ought to take note of an inexpensive remedy recommended by a committee of the Central Railroad Club. It consists of thoroughly washing the places with water, which is followed by a solution composed of chloro-naphtholeum, one gallon of the compound to a gallon of water. Those who have tried this remedy for nastiness say it is very efficient, and makes the use of ice and other disinfectants in urinals unnecessary.

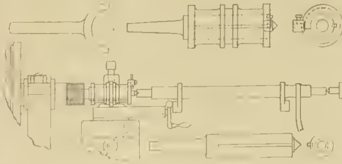
When the first part of what is now the Chicago & Northwestern Railway was chartered in 1836 the proposal was made to call it the Chicago & Galena Union. This name was objected to, on the grounds that Galena was a more important place than Chicago, and so it was named the Galena & Chicago Union. There is some change in the relative standing of the two places since that time.

Announcement is made of the removal of the Westinghouse, Church, Kerr & Co.'s office from Atlantic avenue, Boston, to Exchange Building, 53 State street, of that city.

Simple Tool for Turning Lift-Shaft Bearings.

At the Denison, Tex., shops of the M., K. & T. they use one of the best designs of the well-known plans of turning off tumbling-shaft bearings.

A long center goes into the live spindle, and a sleeve, sliding on a feather fitted



on the center shank, carries the tool for cutting. A fork held in the tool post and fitting the groove on outside of the sleeve furnishes a means of feeding the tool.

Very elaborate plans for elevating most of the surface railroads running into Chicago have been worked out by Col. G. Howard-Ellers consulting engineer for the City Council of Chicago. There are stupendous difficulties in the way of elevating the complex system of tracks, for there are numerous crossings by other roads of lines that must be elevated, so it has taken ingenious scheming to avoid calling for a great deal of double elevation of tracks. Col. Howard-Ellers appears to have done his work with remarkable skill. He is unusually well informed about elevated railroad matters having designed the first elevated railroad proposed for Chicago.

The Engineer, New York, announces the publication of a series of lectures on marine engineering, which have just been delivered by Passed Assistant Engineer W. M. McFarland, U. S. N., before the Naval College at Newport. These lectures were carefully prepared with a view of best suiting the audience addressed, a number of naval officers interested in engineering but not desiring a highly technical treatment. Any of our readers interested in naval engineering matters will find these lectures very interesting. They began in the October issue of *The Engineer*, and will extend through January.

Consolidated Car Heating Co., Albany, N. Y., has received this week an order from the People's Traction Company, of Philadelphia, for the equipment of 300 cars with its system of electric heating. This is the largest order ever given for electric heaters. Other large orders recently received by the Consolidated Company, are 149 car equipments for the West End Railway, Boston, 187 for the Union Railroad, Providence, 60 for the Nassau Road, Brooklyn, and many other smaller orders aggregating in all about 500 car equipments.

Where Hand-Books Differ.

We have discovered that a species of literature very badly in want of reform is engineers' books of reference. We have been for years in the habit of consulting engineers hand-books for facts relating to work we were engaged in, and it never occurred to us to doubt the accuracy of the information found. We were aware that some men preferred one book of reference and others another, and we had heard the remark made that such and such book was no good, but we supposed the objections were raised to the arrangement and not to the accuracy of the data. A new light has dawned upon us lately. It came in this way. Two questions had been answered which related to the melting point of gray cast iron, and on reading the proof we discovered that there was over 1,000 degrees difference in the melting points given. One question had been answered by the S. P., the other by the J. P., and each consulted his favorite engineers' book, with the result stated. Then it was determined to compare a few books used for reference. Here is what we find:

	Melting point of cast iron Fahr.	Melting point of steel Fahr.
Haswell	[illegible]	[illegible]
Trautwine	[illegible]	[illegible]
Clark's Tables	[illegible]	[illegible]
Ramapo Co.'s Hand-Book	[illegible]	[illegible]
Scranton Colliery Engineering Co.'s Hand-Book	[illegible]	[illegible]
Jones & Laughlin's Hand-Book	[illegible]	[illegible]
Greenwood on Iron and Steel	[illegible]	[illegible]
Rolland's Iron Founder	[illegible]	[illegible]

The Committee of the Master Mechanics' Association on gauges for sheet metal, tubes and wire have sent out very comprehensive circulars to members of the association and to manufacturers, requesting the expression of views on the necessity for an improvement in the system of gauges. In the circular they say: "It is evident that nothing but confusion can result from the present practice of ordering by Birmingham or Stubbs, Imperial Birmingham, American, United States Standard and other gauges (often without making any reference to the name of gauge in the orders), and we believe that if a system of ordering sheet metal, wire and tubing by expressing the thickness in decimals of an inch should be generally adopted, all trouble from this source would cease, and there could be no ambiguity under any circumstances."

We have received from the Lunkenheimer Co., Cincinnati, a very handsome catalogue and price list for 1895. It appears to contain everything in the line of steam specialties that we can think of. It has cups of all kinds and sizes, lubricators, gauges, whistles, safety valves, and, in fact, everything required in the fitting up of steam boilers and in the lubricating of machinery. Parties interested in these things will find the catalogue a very useful reference. A good feature about the publication is that it is cut to the Master Mechanics' standard size.

Half a year is nearly gone since the railroad mechanical conventions were held. We learn that some of the committees that have to report at the next convention are already actively at work. That means that the reports will be ready in time, and that the investigations will be thorough. This is a good time to indulge in good resolutions. The members of committees might with justice resolve not to leave all the work to the chairman and if they held to their resolution it would profit themselves and the association.

We have received from the Sterlingworth Railway Supply Co. a canvas pocketbook intended for holding papers and memoranda. A very good feature about the pocketbook is a tablet on which notes can be taken and erased after they are noted in a more permanent position. Railway men who wish to obtain this pocketbook should write to the Sterlingworth Railway Supply Co., 256 Broadway, New York.

A curious form of car brake shoe and dresser has been patented by James E. Worswick, Americus, Ga. It consists of a piece of spiral, hard metal set on the outside of the shoe, inclosed in a softer metal, the purpose of the hard metal being to cut away the part of the tire which does not usually wear by contact with the rail. Its purpose is to perform the functions of the Ross-Meehan shoe by a different form of construction.

The West End Railway, of Boston, has ordered 149 cars equipped with the electric heater manufactured by the Consolidated Car Heating Company, Albany, N. Y. This is perhaps the most important order yet given in electric heating, and was obtained by the Consolidated Company only after most rigorous practical tests in competition with electric heaters offered by five other companies.

The human nature part of railroad travelers appears to be about the same now as it was in 1857, when Oliver Wendell Holmes wrote "The Autocrat of the Breakfast Table." In that delightful gossipy book he speaks of having "sat behind females that would have the window open when one could not wink without his eyelids freezing together."

The boiler explosion that we illustrated as happening in New South Wales some months ago, we have just learned happened over the fence in the sister colony of Victoria. It is only right to add that this is the first boiler explosion they have had for many years.

A patent has been granted to John Krehbiel, Cleveland, Ohio, for a combination on a railway car platform having two parallel bars under the platform which lock into sockets, the idea being to resist the vertical movement of the platform when low joints are struck.

The Mason Regulator Co., of Boston, are making small feed pumps for boilers and tanks which are reported as becoming quite popular. The pump has many novel features and is very simple in its mechanism. It is a single-acting pump, yet it cannot be stopped on the center.

A Lesson in Dynamics.

An improvement in car brakes has been patented by Peter McMullen, of Buffalo, N. Y. He proposes employing one of the vertical members of the diamond truck as the holder of a beam to which the brake mechanism is attached. It is only intended to apply brake shoes to the inside of wheels.

C. D. Gibbons, the owner of the Coup Coupler Co. patents, at Cleveland, O., is commencing suit against several other drawbar concerns for infringement of patents controlled by him.

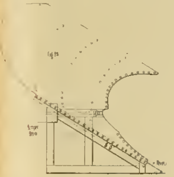
The Elements of Boiler-Making—IX.

SHEET-IRON WORK.

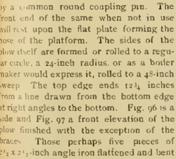
By C. E. Fourness.*

SNOW PLOW NO. 3.

In this paper will be considered Snow Plow No 3, which is an iron plow mounted upon a wooden platform and screwed fast. The platform is also covered with light sheet iron, about No. 12 in thickness. These plows are called platform plows, and this one is very similar to the latest plow built by the C., M. & St. P. Co., and the object the designers had in view was easy attachment to the engine and non-interference with the extended front end, as in the other designs it was necessary to remove the extended arch when an engine was equipped with a plow. Notice this



plow attaches similar to a pilot to the bumper beam, and the same braces that hold a pilot hold this plow up to place, also the draw bar is held in the jaw shown by a common round coupling pin. The front end of the same when not in use will rest upon the flat plate forming the nose of the platform. The sides of the plow itself are formed or rolled to a regular circle, a 24-inch radius, or as a boiler maker would express it, rolled to a 48-inch sweep The top edge ends 12¾ inches from a line drawn from the bottom edge at right angles to the bottom. Fig. 96 is a side and Fig. 97 a front elevation of the plow finished with the exception of the braces Those perhaps five pieces of 2½ x 2½-inch angle iron flattened and bent on the ends to fit and bolt to the angle iron ribs to hold the sides at the right distance apart, will also require braces to hold the plow down in place, and others again to attach to the smokestack saddle

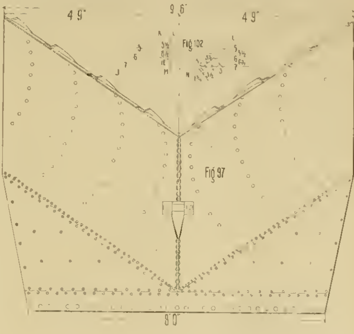


bolts, and bolts to hold the front end castings to the smoke arch. I do not show these, as most master mechanics have distinctive ideas of their own on these matters, but would state that a draughtsman can show just about every hole required if he wishes, and in such shape that they can be laid out on the straight sheet without referring to anything but the drawing. But I will explain later how a boiler-maker can find in a practical manner the location of the holding down braces, providing he has the frame or platform. But a great many times the platform is being built the same time as the plow, consequently it is not always accessible. Of course, a pattern can be made from the first one, and then everything will go along with very little trouble.

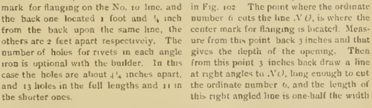
Well, now to business The first thing necessary is to find the angle the center line forms to the side. This is found in the triangle, Fig. 98, the length of the base (the center line being 6 feet long, see Fig. 96) and the height of the perpendicular being equal in length to one-half of the width of the plow at the back, viz, 4 feet 9 inches, see Fig 97. Then the diagonal line connecting the ends of these lines is the length of the side and the angle at the point is the angle desired. I would caution any one when laying out a plow to be very particular to use the right angle, as I remember a case where the draughtsman showed one side laid out similar to Fig. 100. On the working drawing he had the distance marked in feet and inches that the center mark for flanging was located upon the lines 1, 2, 3, 4, etc., from the end line at the point at right angles to the above-mentioned lines. In getting out this plow, I asked the foreman if I should lay out the point and prove the drawing, or work to the same. His reply was, work to the drawing. I followed instructions, and when the point was fitted together the plow was about 4 feet too narrow at the back. Of course, there was excitement for a while. The master mechanic's attention was drawn to it by the foreman; he sent for the draughtsman, after telling the foreman that we should have proved it, and the draughtsman claimed it was in the rolling, etc., to which I, of course, entered vigorous protest. But it was agreed that we should do the laying out in the boiler shop thereafter, as we had made them by the dozen and had no trouble previously. But I was obliged to block up the sides and mark them off with a large square, where they would trim and flange, to come right All this trouble by not having the right angle at the point.

Now for Fig. 99. Draw the base line *A B* and the line *C D* at the same angle as the point formed by the center line and the side, Fig. 98; then draw *E F* at right angles to *A B*, and 3 feet 1½ inches from the point As this sweep is a regular circle, 2 feet or 24 inch radius, set the trams to that distance, and with one point set on the line *A B*, and at a point 2 feet from *F* draw the arc *F G*, locate *G* 12¾ inches from the line *A B*, and mark off this arc into 16 points, and number them from 1 to 16, beginning with No. 1 at the bottom or at F. Draw ordinates through these points parallel to *A B*, and cutting the line *C D*. It would be best to number these ordinates at the point to prevent mistakes or confusion.

Everything is now ready for the sheet, Fig. 100. If the sheet to be used is not large enough, and will require to be made of several pieces, if to be butted, set the pieces together, and the rivet holes for the seams can be laid out when laying out the remainder of the sheet; but if lapped, I think it would be best to get the several pieces punched and bolted together first. Then space off a line drawn at right angles to the bottom and 3 feet 1½ inches from the end of the sheet; that is, to form the point. Space this line into 16 points with the dividers set same as when used to space the arc, Fig. 99, and draw lines through these points parallel to the bottom and the full length of the sheet. Take a strip and mark the lengths of the ordinate Nos. 2, 3, 4, 5, etc., between the lines *C D* and *E F*, upon it numbering the mark the same as the ordinate from which the length was taken on Fig. 99. Carry this strip to Fig. 100, and mark the lengths upon the correspondingly numbered lines, measuring from the line drawn at right angles to the bottom. Make a center mark at each of these marks as a guide for flanging, and after drawing a line 1½ inches outside of these marks for the flange the point is O.K. Now for the back. As the sides are one sweep the whole length, the back will be exactly the same shape as the line for flanging at the front. As all the ordinates are the same length, set the trams to the length 7 feet 8 inches or mark it upon a strip, and using this as a measure, mark the length upon the different lines. Fig 100, measuring from the center marks for flanging. Then a line drawn through these marks will be the line for shearing at the back end. As these sides are made of quite large sheets of iron, and when the plows are perform-



ing the arduous labors required of them, they are under an immense strain and require to be well braced. It is customary to rivet angle iron ribs to the back to stiffen them, and they (the ribs) also furnish a convenient fixture to which to attach the braces. In this case there will be four ribs 2x2 inches attached to each side The center of the holes for the front one to be located 6½ inches from the center mark for flanging on the No. 10 line, and the back one located 1 foot and ¼ inch from the back upon the same line, the others are 2 feet apart respectively. The number of holes for rivets in each angle iron is optional with the builder. In this case the holes are about 4¼ inches apart, and 13 holes in the full lengths and 11 in the shorter ones.

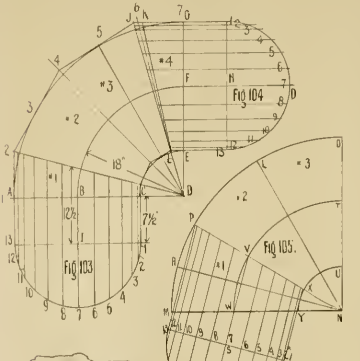


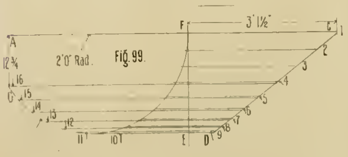
Next in order comes the hole for the drawbar, and in order not to spoil the appearance of Fig. 96 and make a confusing number of lines, etc., upon Fig. 99, I construct Figs. 101 and 102. Fig. 101 is the point of the snow plow exactly similar to Fig. 96, only that it just shows enough to give the location of the hole for the drawbar, Fig. 102; shows the ordinate numbers 5, 6 and 7, the ordinates that pass through the drawbar hole and on which the depth of the hole is to be measured. This small section is exactly similar to the same part of Fig. 99, the arc *J K*, Fig. 102, being part of the arc *F G*, Fig. 99, and the lines *L M* and *N O*, Fig. 102, being same as *E F* and *C D*, Fig. 99, respectively. As the opening desired is curved to quite an extent, draw two extra ordinate numbers 5½ and 6½ between the regular ordinate numbers 5 and 6 and 6 and 7. The lines numbered 5, 6 and 7, Fig. 101, must be located the vertical height those points occupy above the bottom line of the plow referring to Fig. 102. Point number 5 is 5½ inches above the line of the bottom, or *L M*, point number 6 is 8½ inches above the line of the bottom, or *L M*, and point number 7 is 12 inches above the same line consequently these lines 5, 6 and 7 must be located this distance above the line of the bottom, Fig 101. Draw the lines 5½ and 6½ midway between numbers 5 and 6 and 6 and 7. Now for results. Measure from the center mark for flanging on number 6 line, Fig. 101, to where the line of opening cuts the line number 6, this distance is 3 inches, and is marked upon number 6 line in Fig. 102 The point where the ordinate number 6 cuts the line *N O*, is where the center mark for flanging is located. Measure from this point back 3 inches and that gives the depth of the opening. Then from this point 3 inches back draw a line at right angles to *N O*, long enough to cut the ordinate number 6, and the length of this right angled line is one-half the width of the opening at this point in Fig 97, and the 1½ inches the length of the ordinate between the point of intersection of the right angled line with the ordinate number 6, and the center mark for flanging is the distance between the edge of the opening and the center mark for flanging on the number 6 line, Fig. 100. Transfer the distance 3½ inches between the center mark for flanging and the edge of the opening on the line number 6½, Fig. 101, to the line *N O*, Fig. 102.

Measuring toward the back from the intersection of that line with ordinate num

*Foreman Boiler-maker, C., M. & St. P. Ry., Dubuque, Iowa.

ber 6½, draw a line from the point just found at right angles to N O long enough to cut the ordinate number 6½. Then the length of this latter line will equal one-half the width of the opening in Fig. 97 at this point, and the length, 5 inches, of the ordinate must be transferred to line number 6½, Fig. 100, measuring from the center mark for flanging. Mark the length, 1¼ inches, between the center mark for flanging and the edge of the opening, Fig. 101, upon the line N O, Fig. 102, toward the back from the intersection of ordinate number 7 with N O, draw a line at right angles to N O long enough to cut the ordinate number 7, and the length of this latter line equals one-half the width of the opening in Fig. 97. At this point and the length, 2 inches, of the ordinate number 7, between the point of intersection and the center marks for flanging, is the distance from the center mark for flanging to the edge of the opening on the line number 7, Fig. 100. Set the dividers to the distance from the center mark for flanging to the top of the opening where it cuts the line for flanging, Fig. 101, carry this distance to Fig. 100 and mark it across the line for flanging above, measuring from the center mark for flanging on the number 7 line. For the bottom, the edge of the opening just cuts through the point of intersection of the line for flanging with the number 5½ line. Measure from the center mark for flanging on the number 5 line, Fig. 101, to the termination of the opening on the edge of the flange, and mark this distance upon the line on the edge of the flange, Fig. 100, measuring from the center mark for flanging on the number 5 line, then a line drawn through these points of intersection just found will give the line to shear or cut to.



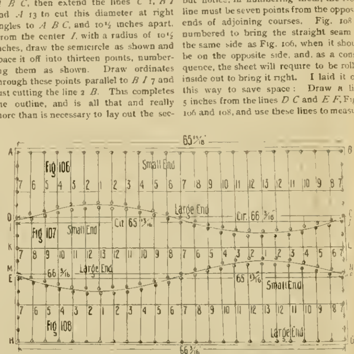


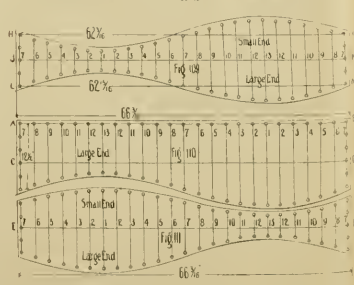
To form the opening for the drawbar. The side is now ready to shear and punch, and after this is accomplished mark off the other side from it, using the first side as a pattern, after turning it over, as one side is to be right, the other left. When both sides have been sheared and punched, they require to be rolled to the 48-inch sweep, and after they have been rolled and rounded up, the angle iron ribs can be fitted, as can also the straps for the butt joints, providing it was necessary to piece out the sheets, and the pieces were butted. Then take the pieces that require flanging to the flange fire and start at the long slim point at the bottom, and be careful in heating not to heat the sheet back of the center marks for flanging, as I always found everything progressed smoother and nicer by following that method. And to see when it is flanged over enough, sight over the flange from the top, as, notice in Fig. 97, by looking over the flange it is possible to see when it presents a plane surface. After flanging, in fitting the sheets together at the point, I made a practice of laying out and punching the rivet holes in the flange of the sheet forming the right side of the plow before fitting together, as then in screw punching the other side the lever requires to be pulled down to punch. After the one side is punched, set the two sides together at the long bottom point and set about 24 inches of the flange nice and even, using tongs with rings on the handles to hold them together to place. Take the screw punch and punch say three holes, one at the point, the others perhaps 10 or 12 inches apart. Put temporary or fitting up bolts in these holes to hold that part, then shift the tong and set the flanges higher up, punch additional holes for bolts and proceed in a similar manner until the top is reached, then come back over the flange and punch all the holes. I would generally, as these plows are quite heavy, set the plow upon the platform in pieces and bolt it together there, after raising the point of the platform so the deck lays level.

HOW TO MAKE AN ELBOW NO. 2.

In this article I will show three different methods of laying out elbows. I will not show an elevation of these elbows, but take it for granted that it is not necessary in this case. Figs. 103 and 104 are the outlines of an elbow of four sections made of No. 16 iron, and 21 inches in diameter. Fig. 105 is also the outline of an elbow of three sections made of No. 16 iron, to connect two pipes 21 inches in diameter. First construct Figs. 103 and 104 by drawing the lines *A B C D* and *D E F G* at right angles to each other. Set the trams to a radius of 18 inches and draw the arc *B F*. The center line draw *A G* and *C E* 10½ inches each side of *B F*, or 21 inches apart. Divide the arc *A G* into seven points, number them, and draw lines from the center through these points Nos. 2, 4, 5 and 6, and the line of rivet holes for the girth seams will be upon the lines Nos. 2, 4 and 6. Draw the line 1/13 for a diameter parallel to and 7½ inches from *A B C*, then extend the lines *C* 1, *B I* and *A* 13 to cut this diameter at right angles to *A B C*, and 10½ inches apart. From the center *I*, with a radius of 10½ inches, draw the semicircle as shown and space it off into thirteen points, numbering them as shown. Draw ordinates through these points parallel to *B I* 7 and just cutting the line 2 *B*. This completes the outline, and is all that and really more than is necessary to lay out the sections needed by an every-day method, and, as stated previously, as a man gets posted or rather becomes experienced, he draws no more lines than absolutely necessary to gain his points, as if the semicircle were drawn from the center *B* and the ordinates drawn to cut the lines *A B C* and 2 *D*, the measurements could be taken between these two lines and save drawing those extra lines. But I have outlined the whole of the number one course or section.

Now for sheets. In this case three are laid out. Fig. 106 is No. 4, Fig. 107 is No. 2, and Fig. 108 is No. 1 course. As it is intended to work on three courses, it will be best to outline them all at once by drawing *A B*, *C D*, *E F* and *G H* parallel and 12¼ inches apart, as that is the average width for Nos. 1 and 4 courses; then *I J*, *K L* and *M N* parallel and 5 inches apart, as 10 inches is the average width of that course, Fig. 107. As the courses are 21 inches in diameter, the circumference is required for that diameter, and is $21 \times 3\frac{1}{7} = 66 + \frac{3}{16} = 66\frac{3}{16}$ inches for the large end, and $66 - \frac{3}{16} = 65\frac{13}{16}$ inches for the small end. Locate the lap holes on the large end $66\frac{3}{16}$ inches apart on the lines *D C*, *M N* and *H G*, and on the lines *A B*, *I J* and *E F*, the lines for the small end $65\frac{13}{16}$ inches apart and an equal distance each side of a center line drawn at right angles to the lines for the large ends of the courses. Space off each end for twenty-four holes and draw lines to connect the correspondingly numbered holes on each end of the different courses. Number these lines, beginning with No. 7 at the straight seams, but notice, in numbering them, the No. 1 line must be seven points from the opposite ends of adjoining courses. Fig. 108 is numbered to bring the straight seam on the same side as Fig. 106, when it should be on the opposite side, and, as a consequence, the sheet will require to be rolled inside out to bring it right. I laid it out this way to save space: Draw a line 5 inches from the lines *D C* and *E F*, Figs. 106 and 108, and use these lines to measure from, as they are the same distance from the lap holes on the curved end as the center line is in Fig. 107. Set the dividers to the length of the ordinate number 1, Fig. 103, between the lines *A B C* and 2 *D*. This length convey to the No 1 line in Figs. 106 and 108, measuring from the last lines drawn, and to Fig. 107 on the No. 1





line. Mark this distance on each side of the center line $K L$, measuring from the latter line. Set the dividers again to the length of the ordinate number 2, Fig 103, between the lines $A B C$ and 2 D. This length convey to Figs. 106, 107 and 108, marking this length upon the lines No. 2 and upon each side of the center line in Fig. 107. Set the dividers to the length of the ordinate number 3, between the lines $A B C$ and 2 D, Fig. 103. This length convey to the three Figs 106, 107 and 108, and mark this length upon all the lines No. 3 in all the figures, and on each side of the center line in Fig. 107. Proceed to convey the lengths of the other ordinates in a similar manner, and these points found will be the center of the rivet holes on the curved ends. Give the plain ends of Figs. 106 and 108 the camber, as they will rivet to an ordinary taper course. Space off the straight seams for four rivet holes and Fig 107 for three holes, exclusive of the lap holes, then allow ½ inch all around outside of the holes for the lap, and these sheets are all ready.

After shearing and punching, mark off another course similar to Fig. 107, only that Fig. 107 must be turned over to mark off the course, as the straight seam must be on the opposite side. The whole number of the courses required could be marked off from Fig. 107, using that as a pattern, turned either right or bottom side up, to bring the straight seam on the side required. First mark off a course similar to itself, as two of these are required, only using the pattern bottom side up to bring the straight seam on the other side, then when turned over mark off Fig 106. Supposing the sheet to be all laid out, all but the curved (the large) end, keep the lap holes 12½ inches apart upon the lines for the straight seams, and then mark the holes and the lap for shearing from the large end. Mark off Fig. 108 similar to Fig 106, using the small end of the pattern. This completes the first method.

The next method under consideration will be Fig 105. This elbow, as you will notice, is made of three sections, but can be made of any number of sections by dividing the arc $M O$ into the required number of spaces. Draw two lines $M V$ and $V O$ at right angles to each other, set the trams from V to T, and draw an arc or quadrant, this will be the center line. Mark the points O and U 10½ inches each side of the center T, and draw the quadrants. Divide the arc $M O$ into three equal parts, and again draw the center line $R N$ from the center N through the point R, midway between M and P. Draw three lines $P M$ 13, $V W S$ and $N Y$ 1 parallel to each other. Draw the diameter 1, S 13, parallel to $R N$, set the dividers to the distance S 1, and draw the semi-circle, divide this semi-circle into thirteen points and number them from 1 to 13, draw ordinates through these points parallel to $V W S$ and long enough to cut the lines $P N$ and $M N$. This completes the outline.

Now for Fig. 109, the course. Draw three lines, $H I$, $J K$ and $L M$ parallel and 4½ inches apart. The next thing required is the circumference, and before finding that an explanation will be in order. Notice in Fig 105 the line of rivet holes are $M N$, $P N$, $L N$, and $O N$. This brings an ordinary square or taper course to rivet on to one end of these sections, and as it is a well understood fact that a straight line is the shortest distance between two points, the curved line of rivet holes, see Fig. 109, must be considerably longer between the lap holes than the plain end of Fig. 108. And in order to make them an equal length, as they must be, the diameter of the course must be reduced (this is the only drawback to this method, as one pattern answers for all), and to find this new diameter, measure the distance between the outside ordinates $P M$ and $N Y$. This requires a diameter of 20 inches, 1 inch less in diameter, and the circumference equals $20 \times 3\frac{1}{7} = 62\frac{3}{4}$, $62\frac{3}{4} + \frac{1}{16} = 62\frac{13}{16}$ for the large end and $62\frac{3}{4} - \frac{5}{16} = 62\frac{7}{16}$ the small end. Lay off the lap holes on the large end $L M$, $62\frac{13}{16}$ inches apart, and the small end $H I$, $62\frac{7}{16}$ inches apart and an equal distance each side of a center line drawn midway between and at right angles to the line $L M$. Divide the large and small ends into 24 points for rivet holes and draw lines across the sheet through these corresponding points; then set the dividers to the length of the ordinate number 1 from Y to the center line, $R N$ Fig. 105. This length convey and mark an equal distance on each side of the center line $J K$ Fig. 109, measuring from this latter line. Set the dividers to the length of the ordinate number 2 between the lines $M N$ and $R N$, Fig. 105. Convey this length to Fig. 109, and measure and mark this distance on both lines number 2 and on each side of the center line $J K$, measuring from the latter line. Convey all the other lengths of the ordinates in Fig. 105 to the correspondingly numbered lines in Fig. 109. Then after spacing off the straight seam for three holes and allowing ½ inch for lap all around outside of the rivet holes, it is ready to shear, punch and use as a pattern. In marking off the others, the pattern must be turned over to mark one course, so as to locate the straight seams on the opposite sides. This ends the second method.

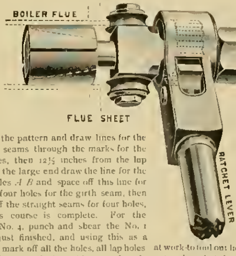
Now for the third. This is shown in Fig. 104. This method was given by a boiler-maker named John Cook in the *Engineer*, and at the time it was given I noticed some one found fault with the method in another mechanical paper, but I will state that I have made elbows by this method and found it simple. The parts fit nicely, and the elbow looks all O.K when finished. This Fig. 104 is for an elbow of four sections, and this end of the outline view is constructed exactly similar to Fig. 103. (I did not think it necessary to make a separate outline view for this method, as one does not confuse the other.) The only difference and all there is to this method is in lines $J L$ and $K L$ cutting off the large and small ends of the sections at a different angle, and the nearer the course cuts off at right angles to the axis or center line the shorter will be the curved line of rivet holes on the ends of the course, consequently, if the line of rivet holes be placed upon the line $J L$, instead of 6 $L D$, the end of the No. 4 course will cut off at a greater angle than the end cut off by the same line in the No. 3 course, consequently the end of No. 3 will be small, and the end of No 4 will be large. As this is No. 16 iron, the point J must be located ¾ of an inch from No. 6. (The allowances for different thicknesses of metal are for No. 16 iron, ¾ inch, for No. 8 iron, 1 inch, for ¼ inch, 1⅛ inches, and for 5/16 inch, 2 inches.) And draw another line from the point K, ¾ inches from 6 to L; the object of this latter line is to save drawing the ordinates through the No. 3 course, as the distance from K to G is the same as the small end of the No. 3 course from 5 to J. Now for the sheets. Draw two lines, $A B$ and $C D$, Fig 110, parallel and 7½ inches apart, then $E F$, Fig. 111, far enough away not to interfere with Fig 110. Lay off on the lines $A B$ the circumference of the large end, 66 1/16 inches; space off the line for twenty-four holes, and draw lines from all of these marks through Fig. 111, parallel and right angles to $A B$, and number these lines as shown, beginning with No. 7 at the ends, and in order to have the straight seams on opposite sides it will be necessary to have the No. 1 line on the seventh line from the right end of Fig 110, and the same distance from the left in Fig 111.

Everything is now ready to find the rivet holes on the ends. First take the large end, set the dividers to the length of the ordinate number 1, Fig 104, between the lines $G F E$ and $J L$, this length convey to Fig. 110, and mark this distance upon the line number 1, measuring from the line $C D$. Mark the same length upon the line number 1, Fig. 111, measuring from the line $E F$, set the dividers to the length of the ordinate number 2, between the lines $G F E$ and $J L$, Fig. 104. This length convey to Figs. 110 and 111, and mark it upon the lines number 2, measuring from the lines $C D$ and $E F$; proceed in a similar manner until the lengths of all the ordinates, Fig. 104, between the lines $G F E$ and $J L$, are marked upon the correspondingly numbered lines in Figs. 110 and 111, and these points of intersection are the center of the rivet holes on the large end. For the small end, set the dividers to the length of the ordinate number 1, Fig 104, between the lines $G F E$ and $K L$; this length mark upon the line number 1, Fig. 111, measuring from the line $E F$. Set the dividers to the length of the ordinate number 2, Fig. 104, between the lines $G F E$ and $K L$, and convey this length to the lines number 2 at the small end of Fig. 111, measuring from the line $E F$, transfer the lengths of the other ordinates, Fig. 104, between the lines $G F E$ and $K L$, in the same manner to Fig. 111, and these points of intersection just found will be the center of the rivet holes on the small end. Space off the straight seams for four holes in Fig. 110 and three holes in Fig. 111 exclusive of the lap holes, draw a line one-half inch all round outside of the rivet holes for the lap, and both figures are complete.

I would state that in making this elbow, if only Fig 111 were laid out, sheared and punched, it could be used as a pattern to mark off all the other courses needed. No. 2 course would be just the same as the pattern, then for the No. 1 course, Fig. 110, turn the pattern, Fig 111, over to bring the straight seam on the opposite end, and mark off (the curved end) the large end and lap holes at the other end, remove the pattern and draw lines for the straight seams through the marks for the lap holes, then 12½ inches from the lap holes at the large end draw the line for the rivet holes $A B$ and space off this line for twenty-four holes for the girth seam, then space off the straight seams for four holes, and this course is complete. For the course No. 4, punch and shear the No. 1 course just finished, and using this as a pattern, mark off all the holes, all lap holes included, except the large (the curved) end, then take Fig 111 as a pattern, and turn either right or bottom side up as required to bring the straight seam at the right side. To break joints, bring the lap holes in the small end (the curved end) to coincide with the marks for the lap holes at the blank end and mark off the holes across the end. And this will complete course No. 4, and all that is needed for the elbow, with every hole marked.

There are three methods given here, and, as the showman remarked, "You pay your money, now take your choice."

A Useful Boiler Tool.



The Farris boiler flue beader is a new and useful tool that has recently been placed upon the market, and it seems to possess considerable merit.

The illustration represents the tool in the flue, ready for beading over the end, which is accomplished by revolving the block bearing the rollers, by means of the ratchet lever attached. The block is fed up by the set nut, and the tool is held firmly in its position in the flue by the expanding block, which rests partly on flue and flue sheet.

There is no danger of splitting the tubes or loosening them from the flue sheet in the operation of beading, and perfect work can be done by the most inexperienced hands. By removing one of the rollers, a cutter can be substituted to remove bead or cut the end of flue. The tool can be arranged for power.

For any further information, address Geo L. Weiss, 139 Ingleside avenue Cleveland, O.

Let the Different Departments Co-operate.

In the course of some remarks made by Mr W. F. Merrill, general manager of the C., B. & Q., at a banquet of the Western Railroad Club, he made some good points about the advantage that comes from the different departments of the railway service pulling together. Among other things, he said

"If every department will take an interest in every other department, you can accomplish vastly better results for less money, and that is the great problem before us in this country. So far as our railroads are concerned to-day, with the terrible course of competition among railroads for freight and passengers, and with the almost insane idea that possesses the people of many States that they must cut down the earnings of railroads, it becomes necessary to exercise the most rigid economy.

"I do not believe that I ever impressed my men more fully with the desperate need of economy, than at a meeting that I called at one time of all our master mechanics and superintendents, when I told them that our stockholders would not take any excuse from us whatever if we failed to pay a dividend and that in order to meet the dividend we had got to save it, because the prospect of earning that amount was very small. Well, the result of that was that every man went to his place and put all the brains that he had at work to find out how he could accomplish not only what he had been doing, but more still, with less money than he had been spending before. I know from my experience that mechanical men, as well as men in control of all other branches of railway service, if they are put right down to it, will accomplish immense results with very little money.

"I do very much as an old road master did that I had when I was on a poor railroad—a railroad so poor that we never knew where we were going to get the next meal. A section foreman would come out to him and say to him, Mr. Owens, I want this, I want that or the other. 'Denny, you can't have it, you can't have it.' That was all he said, but if the foreman didn't keep his section in shape he would either discharge him or thrash him, and as he was a great big Irishman he would rather thrash him than discharge him."

The month of October last beat the previous record for the number of train robberies committed in the United States. As a result of this, no doubt, the Government has issued standing offers of reward for the conviction of persons interfering with the mails.

? A. What You Want to Know. ? A.

Don't ask questions that simply require a little figuring to determine, make each question separate. No notice taken of anonymous questions.

A mistake was made in answering question 142 last month. Instead of circumference we should have said diameter of shell.

(148) J. A. H., Burbank, Cal., asks

What is the cost of the mastodon engines built for Brazil? *A.*—About $10,000.

(149) E. C. D., Philadelphia, asks

What is the alloy known as Muntz's metal composed of? *A.*—Six parts of copper to one part of zinc.

(150) M. T., Port Jervis, N. Y., asks

Will an injector work without difficulty if the check valve is located above the water level? *A.* Yes. It will make no difference.

(151) J. B. G., Plattsburg, N. Y., asks

What is the difference between the melting points of cast iron and steel? *A.*—Cast-iron melts at 2250, steel at 2500, according to Haswell.

(152) Fireman, Cleveland, O., asks

What temperature must the iron of ... be raised to before they melt and ... together as we often find the surface ... plates do? *A.* About 2,250 degrees ..., according to Haswell.

(153) S. L., Wilmington, Del., asks

Is there any breed of horses that are ... to doing the work of a one-horse ... engine continuously? *A.*—No. A ... horse steam engine is reckoned to be equivalent to four and a half horses for continuous work.

(154) A. O., Milwaukee, Wis., writes

I want to fill some blowholes with metal. Have tried Babbitt, but it gets loose when ... What will answer? *A.*—An alloy composed of 7 parts antimony, 8 3 parts of bismuth and 75 parts of lead, will expand in cooling, and always stay tight.

(155) K. B. C., Newark, N. J., asks

Who was the first man to conceive the idea of applying the steam engine to locomotive purposes? *A.*—That is not known. The first man to give the idea a practical application was a French engineer named Cugnot. He built, in 1770, a sort of traction engine intended for military purposes.

(156) C. A. R., Pittsburgh, Pa., writes

We have been hearing a great deal lately about aluminum and the important place it is destined to take in the mechanic arts. Do you think it is destined to supplant steel in bridge building soon? *A.*—We do not think that aluminum will ever take the place of steel for bridge building, for the reason that a ton of steel made into bars of equal length is stronger than a ton of aluminum.

(157) Apprentice, Louisville, Ky., writes

I am learning the machinist trade and am ambitious to get along in the world. What should I do to obtain an engineering education that would help me to the top of the ladder? *A.* Take the course of the Correspondence Engineering School, Scranton, Pa. You can do the work in the evenings. It gives the best help we know of for an ambitious young man. We offer the school course as a prize to club raisers. Go in for it.

(158) J. McN., Halifax, N. S., writes

In answer to my question (140) you give rule for finding area of port opening that is simple enough. What I really want to know is how to find the right area for a given size of cylinder, say 10-inch cylinder? *A.*—In order to calculate this properly the piston speed should be known. For a 10-inch cylinder with piston speed of 400 feet per minute, the steam port should be 6½ inches in area. See "Myers' Modern Locomotive Construction."

(159) H. S., Abilene, Tex., writes

As the economy of a compound engine is dependent on the lesser range of cylinder temperature between admission and exhaust, why not decrease the size of the h. p. cylinder—make the ratio 6 to 1, for instance—and cut off as late as practicable in that cylinder? It appears to me that to carry out expansion in the h. p. cylinder is voluntarily throwing away the chief advantage that the compound system offers. *A.*—We would like answers to this question by men who have had experience with compounds.

(160) W. H., Brooklyn, asks

1. Why is an engine keyed at any given point? On the L road here they key on center? *A.*—The center is the rigid point. If the side rod is keyed here it will pass any point. 2. Do main rod brasses pound on centers or on the quarter? *A.*—On the centers, the point there, the push changes to a pull, or *vice versa*. A rod cannot pound when the strain is all one way. Think a little for yourself. If there is a pound on one side when the main rod is on one quarter, look for the trouble on the other side.

(161) Chief Clerk, Chicago, Ill., writes:

We have had a dispute in the supt's office about who discovered electricity first. We have decided to ask you to decide it in your Asked and Answered department. I say it was Franklin, and my friend says Galvani. *A.*—It is about twenty-five centuries since a Greek writer told that when amber is rubbed it attracts light bodies. Who discovered this electrical phenomenon no one can tell. Franklin made important electrical discoveries, but there was considerable known on the subject before his time. Galvani, an Italian physician, discovered magnetism.

(162) J. V. M., Massillon, O., asks

"Would you please tell me where a person may obtain a book or books on the Air Brake System—that is, a person who is entirely ignorant of the system, and who by reading and studying the book or books may obtain a fair idea of it. All the books I have seen advertised were for persons understanding the system, or at least a part of it. *A.*—We know of nothing better than the instruction books sent out by the Air Brake Company for this purpose. If you cannot understand the brake from the pictures in this book, you won't get much of an idea of it from ink and paper.

(163) Ignorance, Rotterdam Jct., N. Y., writes

1. I am running an engine just out of the shop. She is a little lame and hard on coal. The valves have $\frac{1}{4}$-inch lead on one side and $\frac{5}{16}$-inch lead on the other. If the lead was cut down to $\frac{1}{16}$-inch, would it not help her? *A.*—The chances are that it would. There is a tendency to give locomotives too much lead. 2. I am running an engine with a single bar guide. The guide breaks and engine must be disconnected, leaving no way to block the crosshead. I cramp the valve stem with the back steam port open, disconnect back end of main rod, leaving it hanging on guide yoke, push the piston up to the front head and go on. Is it safe to work engine hard in this condition? *A.*—Just as safe as with any other disconnected engine.

(164) R. H. B., Philadelphia, writes

The corrugated furnace admittedly gives greater heating surface than a plain furnace of the same diameter, yet I am told that a corrugated piston will not present greater area for the steam acting upon them than a plain surface of equal diameter. Is not this a paradox? *A.*—There is no paradox or mystery about it. A heating surface increased by corrugations enables the water inside to absorb the heat over a greater area; but that is altogether different from the pressure of steam or anything else upon a corrugated surface. When pressure of steam is applied to a corrugated surface the force applied at one side of the ridge will be at an angle which is balanced by the pressure on the other side, and the two forces act according to the law of the composition of forces, so that the sum of the pressure is the same as if it acted on a plain surface. For instance, if a boat on a canal is hauled by a rope on each side, one inclines to pull the boat to one side, which is resisted by the tendency of the other rope in the opposite direction. The composition of forces makes the effect about the same as if the two ropes were ahead in line of the motion. Steam pressing upon a corrugated surface acts in the same manner.

List of locomotive engines built by Messrs. Edward Bury & Co., of the Clarence Foundry, Liverpool, and sent to American railroads

Date when built.	Name of Engine.	Name of Railroad Company.
1831	"Liverpool"	Petersburg.
1832	"Roanoke"	Rich., Fr'd'ksburg & Poto.
1833	"Meherrin"	Raleigh & Gaston.
1833	"Appomattox"	"
1833	"Creole"	Pontchartrain
1834	"Staunton"	Raleigh & Gaston
1834	"Petersburg"	"
1834	"Georgia"	South Carolina.
1834	"Augusta"	"
1835	"Boston"	Boston & Providence
1835	"Augusta"	Rich., Fr'd'ksburg & Poto
1835	"Fr'd'ksburg"	"
1836	"Lion"	Boston & Worcester
1836	"Wilmington"	Phila. & Wilmington.
1836	"Orleans"	Pontchartrain
1837	"J. Randolph"	Rich., Fr'd'ksburg & Poto
1837	"Sheppard"	"
1837	"Stafford"	"
1837	"Pat'k Henry"	"
1837	"Roanoke"	Raleigh & Gaston.

Total, 20 engines.

"Opposed to All Monopolies."

The above is the heading of an old railroad poster which is shown in the end of the book published by the Pennsylvania Railroad Company describing their World's Fair exhibit. The competing lines in those days used demagogue screaming worthy of a political orator. The poster read:

"The subscribers have placed on the State Road an entire new line of passenger cars called 'Our Line.' These cars have no superior in point of style, comfort and convenience. They have all the modern improvements, and are number one in every sense of the word."

After giving time card particulars the poster proceeds: "These cars are attached to the way train and run in the rear, which gives them a decided preference over any other cars in case of a collision or a run off, which under the best of management will sometimes occur. Our passengers and cars must, from their position in the train, be comparatively free from danger.

"The subscribers are aware of the monstrous monopoly against which they have to contend, but are determined to encounter it, and, relying upon the encouragement of all who are opposed to monopolies and in favor of low rates of fare, they will run this line at the following rates, viz. Three cents per mile, no more nor no less, under any circumstances. These are the lowest rates at which passengers can be carried over this road under the present rates of toll charged by the State, which are 2 cents per mile on each passenger and $4.92 on each car.

"In order that our friends may not mistake 'Our Line,' we give the color of the cars, which is 'True Blue,' and ask the patronage of a generous public to sustain us in our undertaking.

"DAVID MILLER & Co.

"*April 23, 1851.*"

Cleaning of Passenger Cars.

Car cleaning is not a heroic subject for essay writing any more than house cleaning, yet both are equally necessary, and the more that is known about the best processes the better it will be for those who prefer clean to dirty surroundings. There was a discussion on car cleaning at the Central Railroad Club which brought out much valuable information on car cleaning. The following is an abstract of a report made by Mr. R. H. Soule.

"Cars on long runs, of say 200 miles or over, on arrival at terminal stations in summer or non-freezing weather, should be thoroughly washed off on the outside with clear cold water. For such washing, an arrangement, consisting of a hollow handle attached to a perforated brush head, through which a stream of water is applied simultaneous with the rubbing of brush, for use where hose connections are available, has been recommended to this committee as superior to the common car wash brush generally used. Where bucket and brush are used, care should be taken to renew the water before it becomes gritty through successive dippings of the brush.

"The hand rails and door knobs should be wiped clean, the other parts of car body being not wiped but merely washed thoroughly as above. The trucks should also be wiped on the outside, and other parts that can be reached without going under the trucks.

"In freezing weather the cars should be cleaned on outside by dry wiping exclusively. No injury to varnish will occur under this process, and a better appearance will be attained than by the use of warm water.

"In addition to the ordinary washings at end of trips, the practice on one at least of the roads represented on your committee, is to give to the cars at intervals of three months each between shoppings a thorough cleaning with Perfection Car Cleaner, diluted with water, according to condition of car. This compound, however, is absolutely non-injurious to varnish, whether used in full strength or diluted, and may be applied by unskilled labor with perfect safety and with most gratifying results. The cleaner is applied with an ordinary car wash brush, and if the corners of the battens or bottom of panels are especially dirty, a two or four row beed car scrub is used. Cars cleaned under this process come out almost as good as new on the outside, leaving the gloss on the varnish unimpaired."

In the course of the discussion it came out that the Michigan Central people are using very successfully a brush with a hollow bamboo handle, through which the water for washing is applied. Others had tried brushes of this kind with hollow iron handles, but they were found too heavy to be used to advantage.

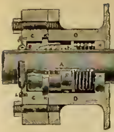
Some facts were advanced to show that soap or any alkaline material used in cleaning cars had an injurious effect upon the varnish. This is found to be the case with the small amount of alkaline matter found in some well water.

Clean water is used more than anything else for cleaning the outside of passenger cars.

The Lake Shore people are using a patented article called Perfection Car Cleaner with success. It is applied in a liquid form and washed off.

On the Northern Central Division of the Pennsylvania about every three months they give the outside a cleaning with crude oil and tripoli.

The cleaning of cushions by means of compressed air is becoming quite general. Some roads employ the same medium for removing the dust from the inside of the car, but the more common practice is to do the work with brushes and waste.



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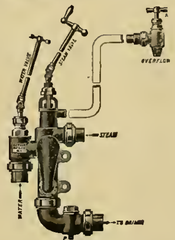

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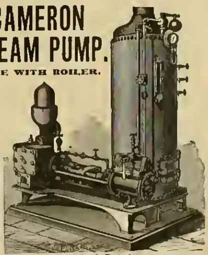

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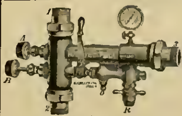

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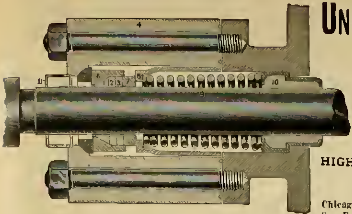

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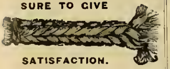

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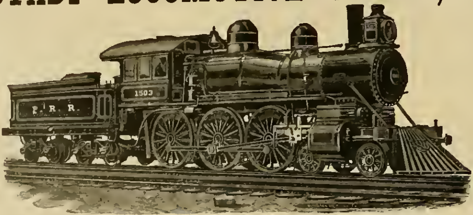

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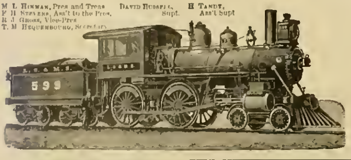

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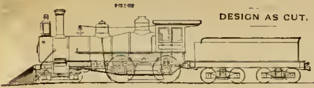

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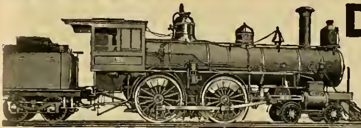

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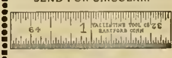

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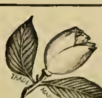

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